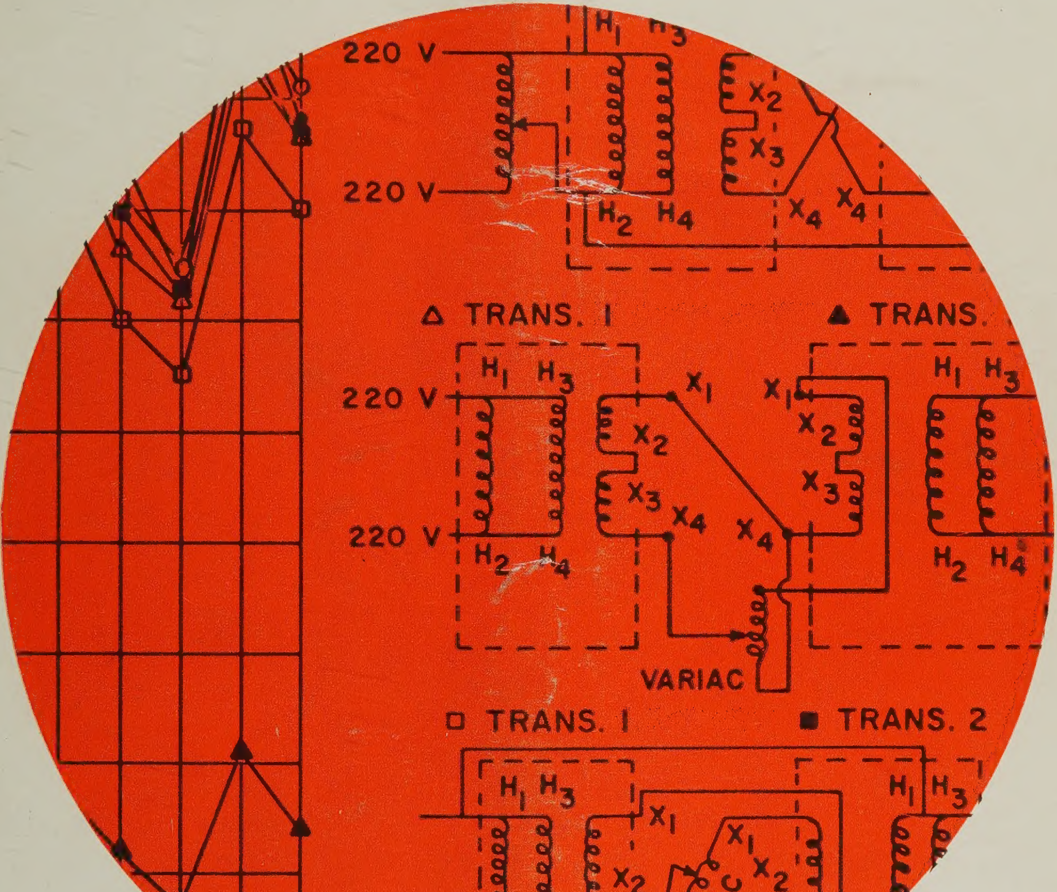
September 1960

Insulation



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New grade of vinyl tubing . . . page 45

EXPAND BEN-HAR "1151"

and get as many as 4 different sleeving sizes

Now with one size of Ben-Har "1151" extruded silicone rubber fiberglass sleeving you can cover as many as four different size applications. Ben-Har "1151" is so tough that it permits expansion of up to 400% increase in a.w.g. size without typical end fray, coating fracture, etc. Easy assembly and snug fit over irregular knobs, terminals, and connectors are assured. Inventories can be greatly reduced because one size Ben-Har "1151" will do the job of several old style "dip coated" sleeving sizes.

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EXTRUSION MAKES THE DIFFERENCE

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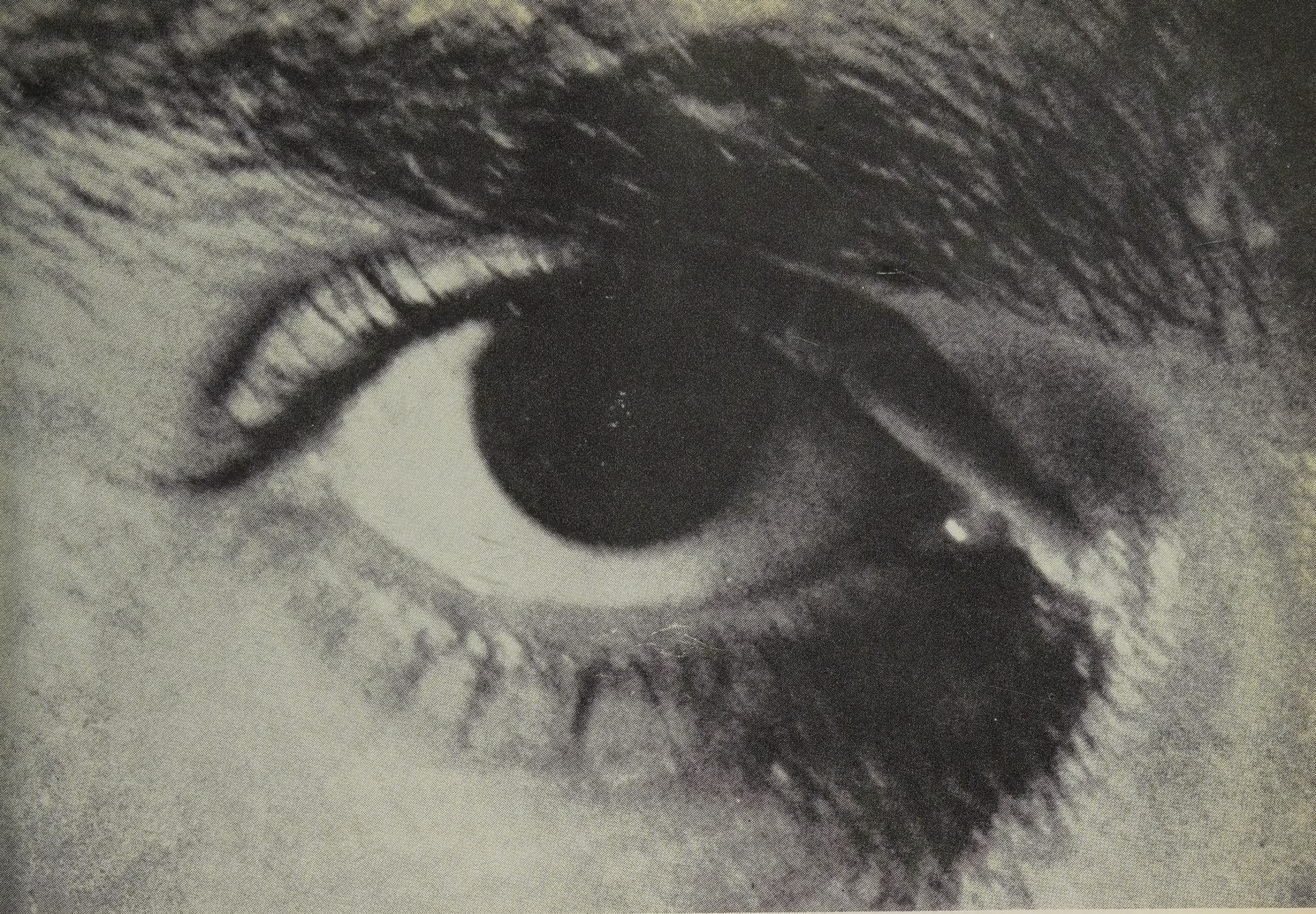

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Concern about you and your problems is why Prehler can do such a superlative job of supplying you with he exact electrical insulation materials you need . . . when you need them . . . in as economical a manner s possible. If you are presently a customer, your Prehler man is concerned about keeping your account, o he is constantly searching for ways to better serve you. And if you are not yet a customer, your Prehler man is concerned about providing services which will help you decide to become a client.

But don't get the idea that Prehler men run around with furrowed brows and long faces—there's a big difference between concern and worry. A long time ago Prehler discovered that it is much better to be concerned in advance than to worry when it is too late. Prehler is concerned about you . . . and there s a huge stock of nearly every conceivable type of insulating material in convenient warehouse stocks plus years of experience to back up this concern. Phone or write, today.

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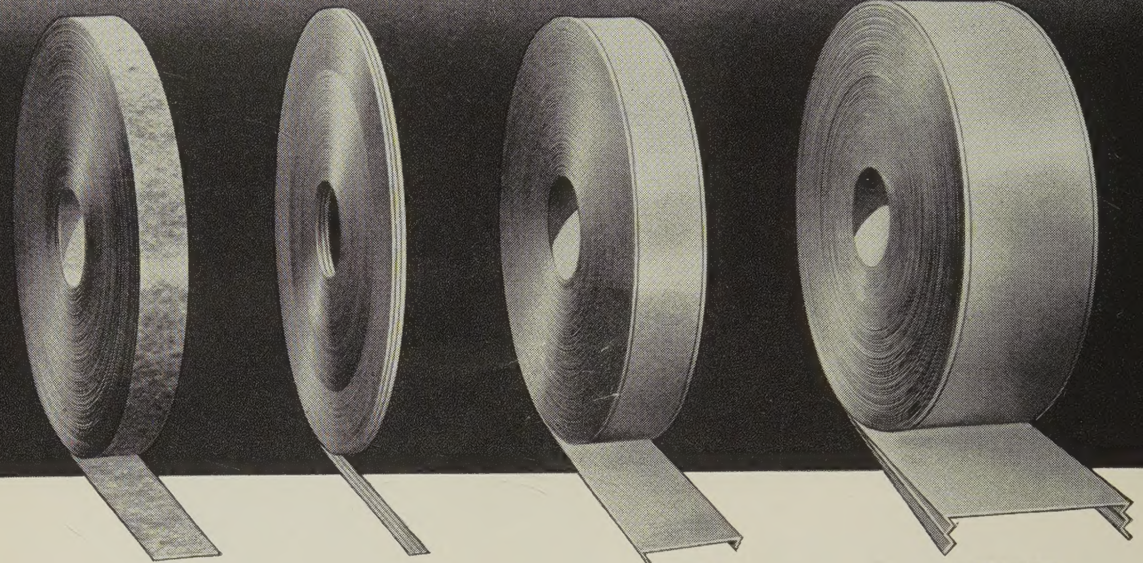
BULK-PACK COILS IN FOUR DIFFERENT STYLES



Inmanco® Precision Insulations

Here are the four basic styles in which you can get INMANCO bulk-pack coils in production lengths:

PLAIN—Precision slit INMANCO coils, fabricated with machine feeding in mind. Coils are hard . . . feed uniformly through automatic inserters . . . give max. yield per roll.

SCORED—Precision slit then scored with one or more scores or creases to permit easy bending when used on the production line as separators between windings.

CUFFED—A bulk stock of given width between cuffs from which slot insulators of various depths can be cut, creased, scored, or formed. Usually single-cuffed coils are used, but double-cuffed are available. Both greatly improve edge tear resistance.

CRIMPED—For transformer layer insulation applications. Have accordion pleats or folds along one or two parallel edges to obtain a barrier at the edge which prevents windings from falling off.

Standard rolls are approximately 15″ in diameter, wound on cores of 1⅛″, 1¼″, 2″, and 3″ I.D. Normal tolerances in widths are ±2% for widths under 1″, and ±1/32″ (or 1%, whichever is greater) for coils over 1″ wide. The table at right lists the most popular styles and materials. However, the scope of INMANCO's modern facilities can supply you with the exact put-up, size, and material needed for practically any application. Call in an INMANCO representative on your next job or send specifications and inquiries to your nearest IMC office.

NORMAL RANGE OF WIDTHS

PLAIN COILS—3/16″ and up (in any thickness) except Mylar† and Mylar combinations which start at ⅛″.

SCORED COILS—3/16″ and up (in any thickness) except Mylar† and Mylar combinations which start at ⅛″.

CUFFED COILS—⅞″ to 10″ between cuffs.

CRIMPED COILS—⅞″ to 24″ between crimps.

Material	Plain	Scored	Cuffed	Crimped
All Rag Papers	Yes	Yes	Yes	Yes*
Tan Electrical Kraft Papers	Yes	Yes	Yes*	Yes*
Fibre (Fishpaper)	Yes	Yes	....	....
Paper-Varnish Cambric Combination	Yes	Yes	Yes*	....
Mylar† Film	Yes	Yes*	Yes*	....
Mylar†-Dacron† Matte Combinations	Yes	Yes	Yes	....
Mylar† Asbestos	Yes	Yes	Yes	Yes*
Mylar†-Paper Combinations	Yes	Yes	Yes	Yes*
Acetate-Paper Combinations	Yes	Yes	Yes*	Yes*

**Depending on thickness* *†DuPont trademark*

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Ave., Libertyville, Illinois, September 1960

19 *Reveal Plans for Special Activities, Program and Exhibitors at Insulation Application Conference*

23 *Insulation Helps Use of Styrene in TV Cabinets*

25 *Evaluating a Specialty Transformer Insulation System by the Proposed AIEE Test Procedure*
D. S. Stephens and E. W. Lindsay

33 *Use of Low-Cost Foil-Clad Paper-Base Epoxy Laminates for Printed Wiring Boards*
H. L. Uglione Jr.

40 *Continuous-Production Vacuum Furnace For Ceramic Wafer Electron Tubes*

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Advertising Sales Offices: See page 104.

From the Editor

Opinions and Rambling Thoughts

Louis McCarthy

It is with regret that we note the recent death of Louis B. McCarthy, general manager of The Macallen Co. Inc. at Newmarket, N.H. Normally, in such cases we express our regrets orally but in this instance there are a few things to be said about Lou McCarthy which we would like to appear in print and which did not appear in the newspaper notices.

First, there is the fact that Lou McCarthy was always willing to lend a helping hand and to encourage others to higher performance. We know this from the personal experience of some years ago when *Insulation* was started and Lou McCarthy helped from an advertising standpoint strictly because he felt the purpose deserved support. It also is little-known that he contributed a great deal, in every way, to various civic projects in his community. Secondly, Lou McCarthy had some good, old-fashioned ideas about business ethics, courtesy, and promises . . . he was a gentleman . . . he will be missed.

Although we regret the circumstances, we are pleased that another friend of long-standing, A. Shirley Gray, will replace Lou McCarthy at Macallen.

Think About It Now, Do It in November!

It isn't too early to start thinking about the elections in November, the qualifications of all the men running for office, and your plans for voting. It seems that our interest in elections decreases as our material belongings increase. We have the opportunity to reverse this trend in the next couple of months. If you are pretty much of a straight party voter, then you should back up your convictions by contributing time and money to your party. If you vote for the man instead of the party, then the least you can do is to make every effort to be sure all your neighbors and associates vote in November. And of course, make sure you vote.

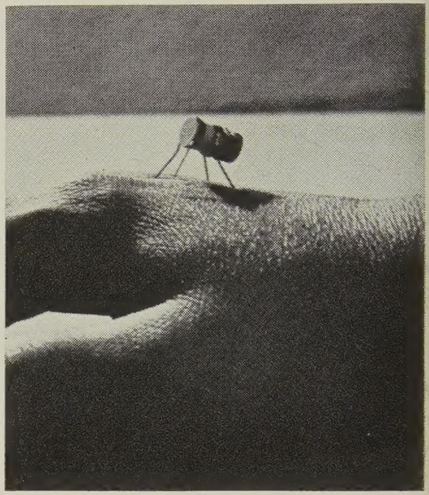
Want a voice in the people's choice?
Don't pass the buck–
VOTE!
DIG DOWN! Contribute
DIG IN! Work for your Party
and VOTE!

A feeling that there is no difference between parties or candiates is no excuse to not vote. Regardless of similarities, there are also basic differences which are revealed only by careful study of the issues and thorough reading of objective news reports. Even if the men you wanted for particular offices were not nominated, certainly one of the nominees is closer, if only to a small degree, to your way of thinking.

It is *your* responsibility to vote. If you don't, you have no right to gripe —it is a case of put up or shut up. Besides, I want my candidates to win and they won't unless you vote (my candidates are supported by the intelligent, good looking voters).

More Bugs

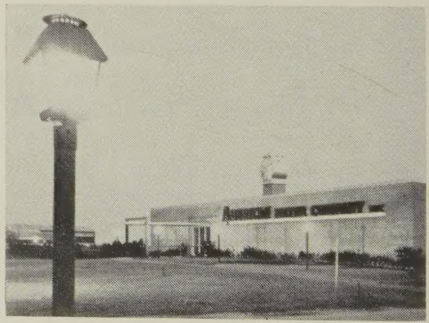
Recently on this page we waxed ecstatic over the good sense and bright thinking of a publicity man who used a fly instead of the conventional paper clip or match stick to indicate the comparative size of an electronic component. Now, we are pleased to see that public relations man Lucien R. Greif has gone one step further and made a bug out of the component.



Actually, just for the record, it is a miniature precision air capacitor less than one-half inch long made by Johnson Manufacturing Corp. Thought you'd be interested in this sequel to the previous story.

Gas Makes a Comeback

A public relations agency had the nerve to send us a photograph designed to show what a fine lighting job gas lamps can do. Since we try to be objective, we are publishing the photograph for you to examine. These lamps are being used to cast a pleasant glow over the grounds and buildings of an industrial plant down in Texas. Now, if you look at the photograph closely, you might notice that the name of the company is American Meter Co. Inc. We'll give you one guess as to what kind of meters the firm makes.



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THERMOFIT compound is the new irradiated insulation material pioneered by Raychem Corporation for difficult environments.

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THE TUBING WITH A MEMORY . .

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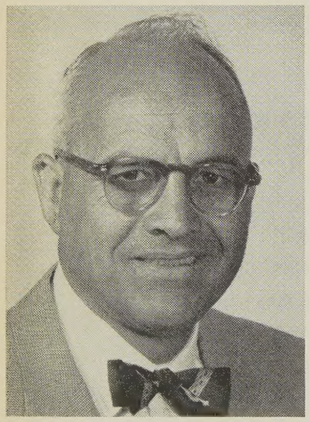
News and Views

Milam Merges with Thompson

More evidence of the continuing merger trend is the announcement that Milam Electric Mfg. Co., Providence, R.I., manufacturer of flexible laminated electrical insulation materials, has merged with Thompson Ramo Wooldridge Inc., Cleveland and Los Angeles manufacturer of products for the electrical, electronic, missile, automotive, aircraft, nuclear, and automation fields. Plans call for expanding existing Milam facilities in order to broaden the existing line of products. Milam personnel is unchanged with J. A. Ruby continuing as president and W. McLean as vice president. Dr. Dean Wooldridge has been elected to the Milam board of directors.

Du Pont Consolidates Insulation Sales

Sales activities for all electrical insulating materials of Du Pont's Fabrics and Finishes Department have been consolidated with Fred J. Emig, former manager of insulation sales for the Finishes Division, heading the new group as manager of insulation sales. The new organization combines the sales force for wire enamels and insulating varnishes with the group handling sales of treated insulating fabrics. Robert L. Lester, previously supervisor of market development in the Fabrics Division, has been named assistant manager of insulation sales. Headquarters are in Lincolnwood, a Chicago suburb.



R. L. Lester

F. J. Emig

New Glass Fabric Firm Formed

M. Lowenstein & Sons Inc., Raymond F. Clark, and Jack P. Schwebel have announced formation of Clark-Schwebel Fiber Glass Corp., New York City, to weave, finish, and market industrial and decorative glass fabrics. Clark was with Owens-Corning Fiberglas Corp. for a number of years until he joined Hess, Goldsmith & Co. in 1947 as sales manager. At the time of his recent resignation, he was executive vice president. Schwebel has been in the glass fabric business since 1947 and most recently served as sales manager of the Industrial Glass Fabrics Division of J. P. Stevens and Co. Inc.

Whither the Market

Of late, the nation's economic wizards and financial pundits have been most notable for their double talk and wordy gyrations—obviously, most of them are using these means to avoid going out on a limb in regard to forecasting what's ahead for the economy. One thing is sure, the boom forecast earlier in the year never got off the ground—in fact, it never materialized at all. The electrical and electronic business men we have talked to in recent months generally agree that the first part of the year was fine from a sales standpoint, but not so fine when profits are examined. The reason seems to be that they could not raise the prices of their products (some had to lower prices) even though the cost of doing business continued to rise.

They have different names for it, but most electrical and electronic businessmen are in agreement that the industry was experiencing some kind of a mild recession during the late spring and summer months. However, the same men are now hopefully pointing to signs that indicate an upswing is now in progress and that 1960 will wind up as a very good year even though it may not be a banner year. Actually, many business leaders prefer a year which is only "good" since it keeps the competitive edge sharp and strong and prevents a build-up of inefficient practices. In addition, "normal" years are greatly favored over years which alternate between extreme upturns and downturns.

Record-Breaking Insulation Application Conference Predicted

Workers on the 3rd National Conference on the Application of Electrical Insulation, slated for the Conrad Hilton Hotel, Chicago, Dec. 5-8, are predicting that commercial exhibit spaces will be a complete sell-out and that all attendance records will be broken easily. To support their rosy opinions, they point to the unusually high advance sales of exhibit spaces and the well-balanced, practical technical program which has been developed. Complete program and other details appear in an article in this issue.

American Cyanamid Introduces Insulation with Diel. Constant of 12.5

American Cyanamid Co. has announced a new film-forming and moldable dielectric material that has the highest dielectric constant (12.5) of all known organic film-forming materials. A chemically modified cellulose, it is claimed to provide a capacitance per unit volume two to six times greater than that of other comparable products. Microminiature capacitors are an obvious application. More details are provided in new product item No. 103 in this issue.

Heat-Resistant Varnish Solves Bonding Problem in Small High-Speed Motors

Advertisement

An interview with Robert M. Henry, District Sales Manager
Schenectady Varnish Company, Inc., Schenectady, N. Y.

Impregnating varnishes used in more efficient, small high-speed motors must hold the coils rigidly in place despite higher operating temperatures. As described below ISONEL 31 Polyester Varnish shows outstanding bond strength in Helical Coil Bond Test.

Q. What is the significance of the bonding strength of an insulating varnish?

A. In rotating equipment this is a measure of its ability to hold the coils of a motor in place without cracking or losing adhesion—despite severe environmental stresses.

Q. Is there a standard test for this?

A. A number of methods have been devised — splints, bundles, screwhead and Helical Coil are the best known. The latter is relatively new, but is in wider use because it more closely resembles the actual insulating varnish bond in electrical equipment.

Q. Why is bond strength emphasized for the newer small motors?

A. It applies equally to motors of all sizes, of course. In small motors though, as operating temperatures rise, conventional varnishes deteriorate, coils are spun loose at high speeds and failures result. The Helical Coil Bond Test provides reliable data on the ability of a varnish to maintain its bond strength at temperatures of 155 C or more.

Q. Since practically all rotating equipment involves both a magnet wire enamel and an impregnating varnish, is this test useful for both?

A. Yes, considerable data has been accumulated for various varnish/enamel combinations in our Electrical Testing Laboratory, some of which is shown at right.

Q. Which combinations seem best suited for small motors?

A. In tests of various magnet wire enamels with a polyester varnish, a polyvinyl acetal enamel showed the highest bond strength. (See Fig. 1). It was closely followed by a polyester enamel.

Q. How about other varnishes?

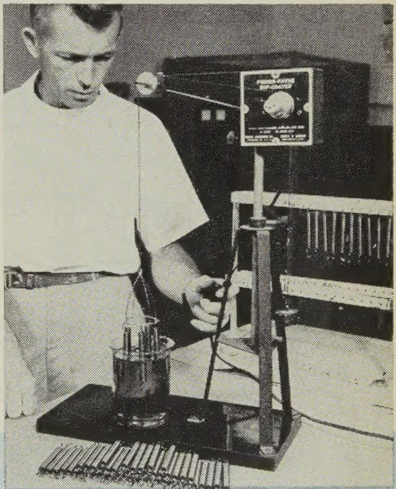
A. Because of their hardness, phenolic varnishes have been used mostly for small high-speed motors. In Fig. 2, however, you see the effect of heat aging on a phenolic vs. our ISONEL* 31 High-Bonding Varnish. Lower to begin with, the polyester increases in bond strength for over 200 hours at 200 C, before bond strength is affected.

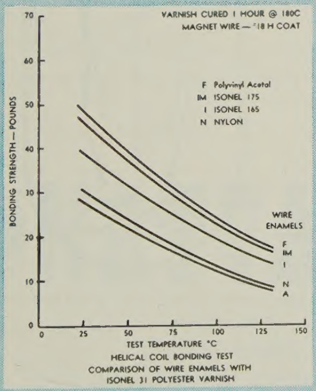
Q. What is your conclusion, then?

A. It depends on the application, of course. In general, we believe best results on small motors are obtained with a polyvinyl acetal or polyester enamel with ISONEL 31 Varnish.

** Reg. T. M., Schenectady Varnish Company, Inc.*

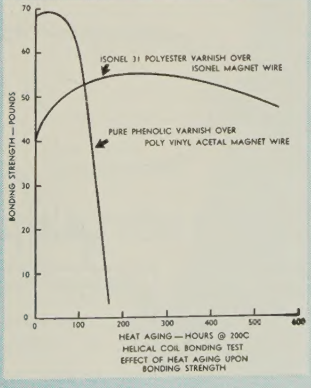
DIP-COATER applies ISONEL Varnish to enameled wire samples.





◀ Fig. 1—Comparison of bonding strength of various wire enamels with ISONEL 31 High-Bonding Varnish.

Fig. 2—Effect of heat aging on bonding strength of phenolic varnish and ISONEL 31 High-Bonding Varnish. ▶



*** Consult your wire supplier for data on ISONEL enameled wire.*

Inquiries should be directed to:
Section E-031

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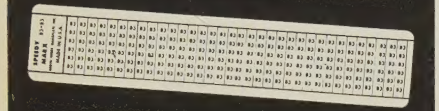

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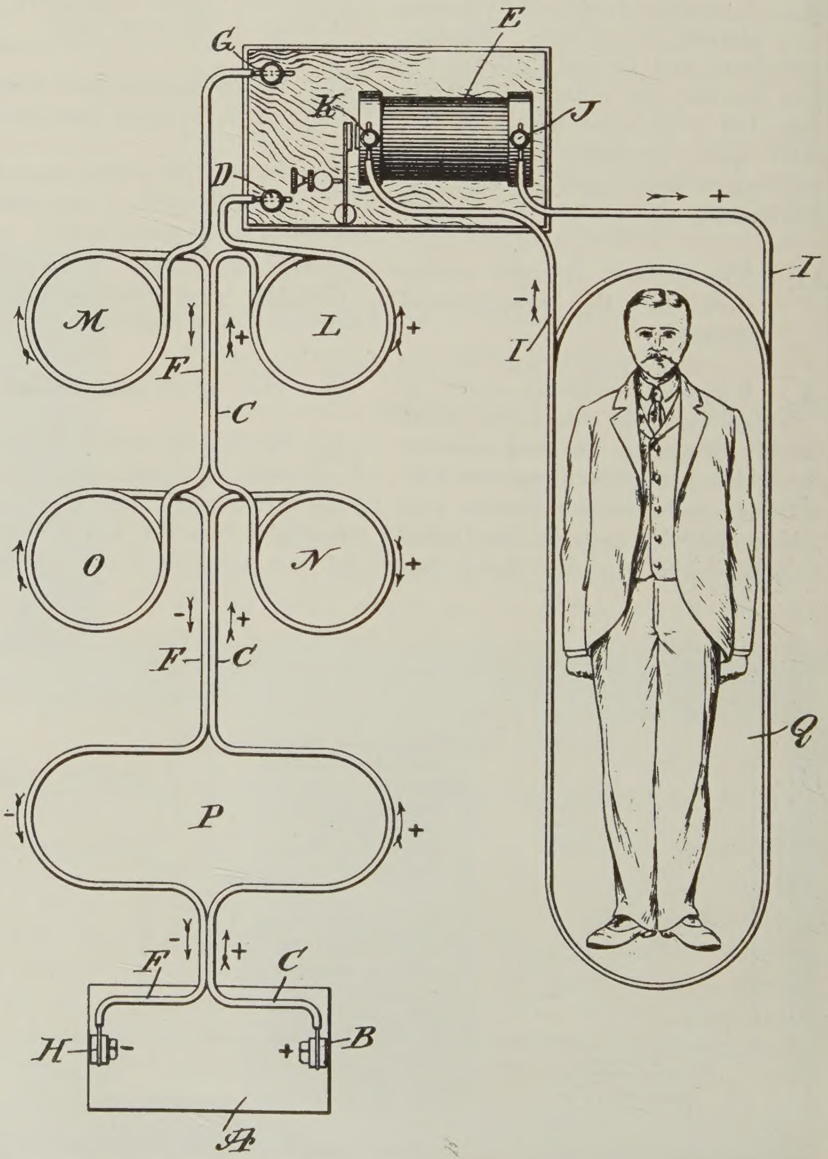
Pixilated Patents

By Mike Rivise

Forty-fifth in a series of odd and interesting inventions in the electronics field from the files of the U. S. Patent Office.

Clear and straight-to-the-point Patent No. 781,448 covers a new and improved electromagnetic apparatus invented by John McIntyre of Jersey City "for stimulating and vitalizing live animal, live vegetable, and other objects and matter by saturating, for instance, the whole human or animal object or the bed-soil of the plant-bed and the plants uniformly with electricity in its normal condition magnetism by the employment of frequency magnetism derived from an electric cable-coil in circuit with a source of variable electric energy or frequency electric current."

The illustration shows a dapper dandy apparently trying to gain a magnetic personality. According to the patent, the "electric source of energy (is) in the form of an electric battery A; but it may be any other suitable source, and the positive pole B of this battery is connected by a flexible conductor C with the primary terminal D of an induction-coil E of any approved construction, and



Natvar

TERAGLAS*

A NEW CLASS B INSULATION HAS RESILIENT WEAVE AND HIGH DIELECTRIC STRENGTH UNDER STRETCH

Natvar Teraglas is a new flexible insulating material comprising a base fabric, woven from polyester (polyethylene terephthalate, or "Dacron") warp yarns and continuous filament glass filler yarns, coated with an improved varnish, possessing exceptional dielectric strength under elongation. It will withstand Class B (130°C) operating temperatures.

In view of the higher dielectric strength of Natvar Teraglas compared to bias varnished cambric, thinner sections or fewer layers may be used to provide the voltage breakdown protection desired. Consequently, at comparable tape prices, a significant saving may be realized in production costs, while permitting up-grading to Class B (130°C) temperatures.

Natvar Teraglas is available in .008", .010", .012" and .015" thicknesses—in tapes, in full width rolls (36"), or in sheets. Ask for Data Sheet and Samples.

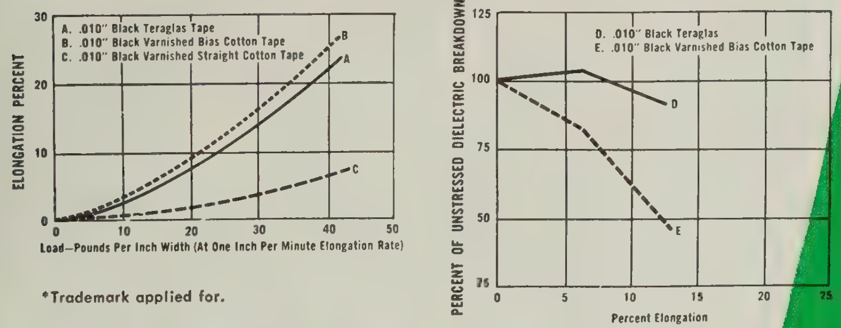
Natvar Teraglas will prove advantageous in many applications — for insulating motors, generators, transformers, cables, switchgear, busbars, and other apparatus and equipment where resiliency and high dielectric strength are desirable.

TYPICAL DATA

Physical Properties:		**.008"**	**.010"**	**.012"**	**.015"**
Approx. weight lbs./sq. yd.		0.43	0.54	0.62	0.77
Breaking Strength lbs./in. width	Warp	45	45	45	45
	Filler	100	100	100	100
Tear Strength, grams	Warp	1000+	1000+	1000+	1000+
	Filler	1000+	1000+	1000+	1000+
Elongation, % (Under 25 lbs./in. width —3 minutes)		9.5	7.5	7.5	7.0

Electrical Properties:	**.008"**	**.010"**	**.012"**	**.015"**
Elec. Breakdown Strength (C48-23-50 V/M)	1600	1600	1600	1600
Elec. Breakdown Strength (Under 6% stretch)	1600	1600	1600	1500
Elec. Breakdown Strength (Under 12% stretch)	1500	1450	1450	1300
Power Factor, %, at 80° C-50 V/M-60 c.p.s.	2.2	2.5	2.5	3.0

LOAD-ELONGATION CHARACTERISTICS FOR NATVAR BLACK TERAGLAS



*Trademark applied for.

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Natvar

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- Varnished canvas and duck—sheet and tape
- Varnished silk and special rayon—sheet and tape
- Varnished papers—rope and kraft—sheet and tape
- Varnished, silicone varnished and silicone rubber coated Fiberglas*—sheet and tape
- Slot cell combinations, Aboglas®
- Teraglas**
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated and silicone rubber coated Fiberglas tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

*TM (Reg. U.S. Pat. Off.) OCF Corp.
**Trademark applied for.

We will be very happy to supply information on any of our products on request.

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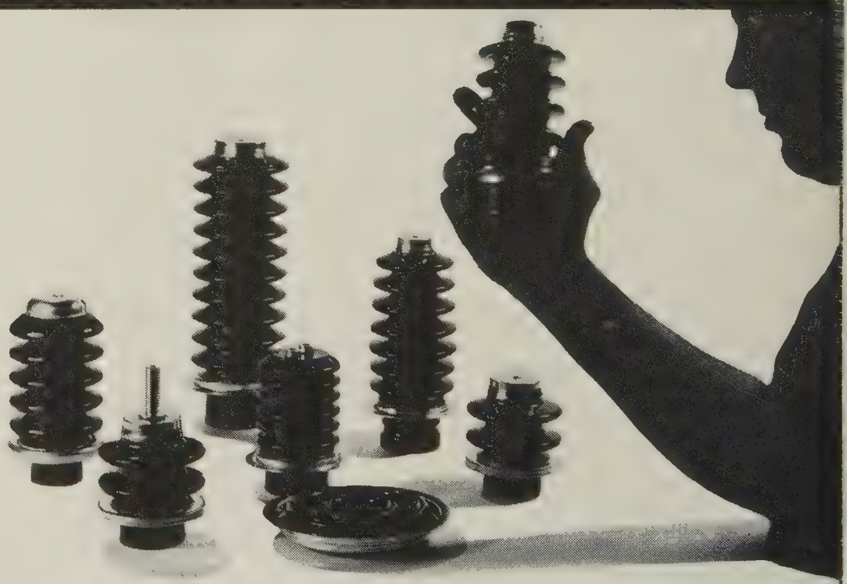
the other primary terminal, G, of the induction-coil E is connected by a negative flexible conductor F with the negative pole H of the battery, thus completing the primary circuit. A flexible conductor I connects with secondary terminals J and K on the induction-coil E, thus completing the secondary electric circuit. Each of the flexible conductors C, F, and I is in the form of a cable, the conductors C and F having portions formed into cable-coils L, M, N, O, an P and the conductor I having a portion formed into a cable-coil Q. The term 'cable-coil' denotes a plurality of insulated conductors, each forming a strand of a cable which is laid into a desired number of convolutions to form each cable-coil capable of producing an effective field of magnetism whenever an electric current is sent through the flexible conductor F, C, or I. Within the magnetic field of the cable-coils L, M, N, O, and P, or any of them, may be placed an object or objects for receiving magnetism, and in like manner the cable-coil Q may be arranged around a human being or around a bed of plants or other object to bring the same within the magnetic field or sphere of magnetic influence of the cable-coil. The portions of the positive and negative conductors not required to apply magnetism should be as close to each other as the necessary insulation will allow and the current flowing oppositely in each (the arrows indicate the direction of the current). This will practically prevent radiation of magnetism from that portion, and wherever it is desirable to coil a portion of the positive and negative conductors adjacent to each other in the same circuit to get the best combined effect of the magnetism from said portion they should each be coiled in the same direction, and to get the best effect of the magnetism where only one coil is formed in either adjacent conductor in the circuit it should be coiled so that the current in the nearest portion of the other conductor shall flow in the same direction as the current in the latter conductor. Whenever the positive and negative conductors contact with each other when the current is flowing in opposite directions in each (as shown by the arrows), the radiation of magnetism from both will be retarded or practically *nil*. The size of the plant-bed or portion of soil or other object bathed with the magnetism is regulated by the quantity and pressure of the current and the length and size of the conductor."

One can't help imagining what a wonderful world this would be if this equipment had done what was expected of it. Our society might now be measured by the number of electromagnets per household instead of the number of automobiles or bathtubs. Regular applications of magnetism might have made true "togetherness" a reality. And think of the advantages to the consumer of food treated in this manner, the benefits that might accrue from regular diets of food fortified with electricity—tired blood, for instance, would probably perk up. Then consider the ease-of-consumption factor. Magnetized food would probably revolutionize our eating habits. For example, magnetized peas would no longer present a problem to those who like to limit their silverware to a knife.

CERAMASEAL ANNOUNCES HERMETIC PORCELAIN-TO-METAL SEALED BUSHINGS FOR OPERATION TO 200°C



Ceramaseal has adapted the process used for its high temperature alumina ceramic bushings to wet process porcelain. The result? Mechanically strong, high vacuum tight porcelain bushings which can be installed by soft soldering or heli-arc welding and easily withstand continuous operation to 200°C.

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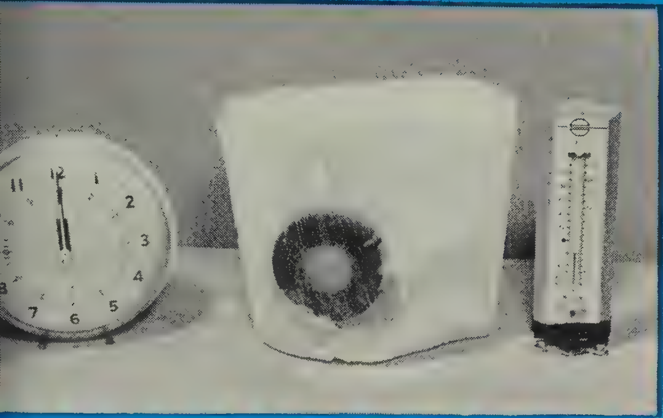
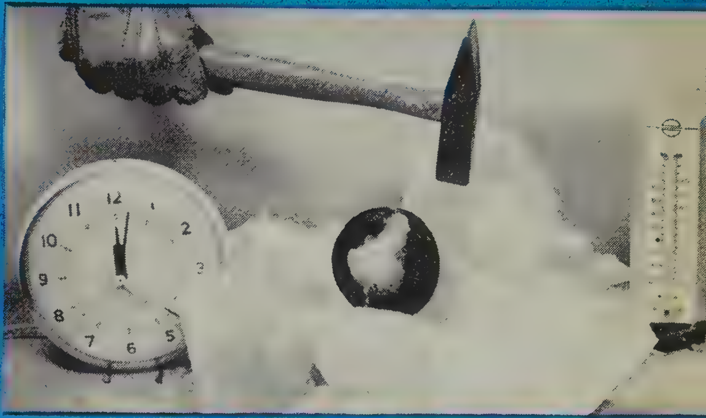
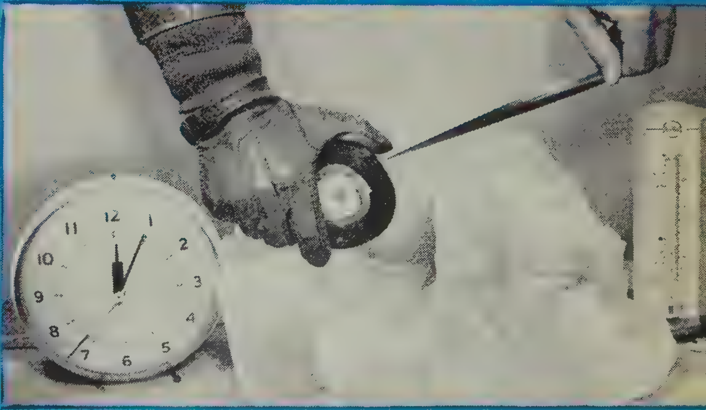


ll of Slipknot CW is frozen solid in a block ce at 14° F below zero.



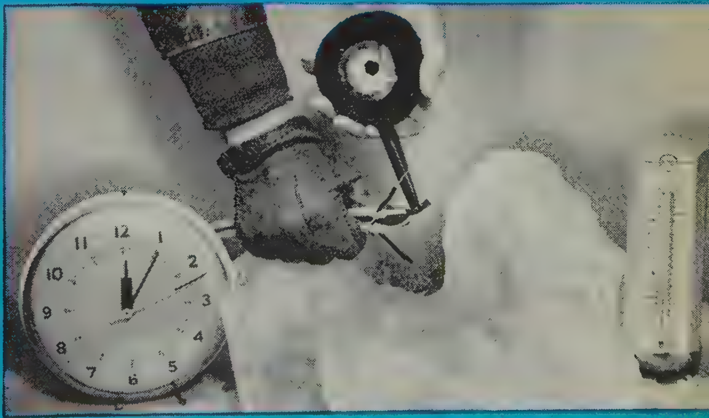
Tape is broken out of ice . . . still at 14 below . . .



and in this frigid atmosphere remains completely flexible — strips perfectly from roll — even with ice still imbedded in the core.

4°F below zero, this remarkable vinyl tape
trips easily from the roll . . .
emains completely flexible . . .
ticks down instantly — molds perfectly —
holds permanently!

in your home freezer
— write for a sample roll
on your letterhead today!



35 seconds later perfectly conforming splice is made. Temperature . . . still 14° below!

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Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

In what areas would you like to have electrical/electronic insulation suppliers provide you with more information — for example, material properties (please specify which materials or classes of materials), production technology (discuss particular manufacturing equipment, methods, etc.), or other areas?

R. M. Light

Head, Electrical Engineering Section, The Leland Ohio Electric Co., Dayton, Ohio.

"The insulating materials used in an electric motor or generator must be considered as a system rather than a collection of individual materials. New materials continue to appear on the market and often, on the basis of the published properties, appear to be adequate for an intended application. Failure of the insulation system, however, can occur because of incompatibility of the materials selected.

"The evaluation of an insulation system is logically the responsibilty of the manufacturer. New materials continue to be developed. The designer, in attempting to utilize these materials in an insulation system, has a problem which increases in magnitude as these new materials appear. The problem is further complicated by the trade name identification of the new materials which gives no clew as to what the basic materials are.

"It is suggested that, in addition to the physical, chemical, thermal, and electrical properties, on which complete information is usually given, some indication as to the compatibility of the material with other basic materials be provided. Although the degree of compatibility is a function of the system in which the materials are used as well as the materials themselves, some guide posts should be available to assist the designer in selecting components for evaluation in the system. Information in the form of a chart listing various general types of materials with three classifications would be of considerable value in giving direction in the application of a new material: namely, 1) completely compatible, 2) possibly incompatible, depending upon system, and 3) usually not satisfactory."

R. J. Arnold

Senior Chemist, Materials Laboratory, Sperry Gyroscope Co., Div., of Sperry Rand Corp., Great Neck, N.Y.

"Electronic insulation suppliers should provide more information on the dielectric behavior of the newer epoxy, polyester, silicone, and phenolic materials at higher temperatures (up to the maximum continuous operating temperature) and frequencies (greater than 1000 megacycles). Since the majority of suppliers' reported data is limited to the 60 cycle to 1 megacycle range, the selection of materials for radomes, potted transformers and electronic circuitry, printed circuitry, dielectric sheet, and radar load materials for high frequency applications is often complicated by insufficient information. Adequate insulation of high frequen-

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Conductor Insulation — Similar
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Rexolite* and Brand-Rex Technical Service Answer Most Microwave Insulation Problems

Across the microwave spectrum, from anode toppers to timing blocks; from antennas to duplexer pins, to filament cores, to light pipes, phaser assemblies and probe insulators; from slot arrays to slip ring disks and sweep arms, to transformer locks and cores, to timers and tubes . . . Rexolite plastic dielectrics and Brand-Rex technical service have teamed to stamp "solved" on a long list of complex microwave insulation problems.

And, it's an impressive reason why! Rexolite thermosetting materials offer a wide range of UHF electrical properties and advantages . . . low loss factor, low dielectric constant, and exceptional resistance to radiation. Pure research into dielectrics at the Enka Research Center in North Carolina and applied research and development by the Technical Development Group at the Acton, Mass., plant have resulted, and will continue to result, in significant new Rexolite types. Adding to its usefulness, Rexolite is available in rods and both plain and copper clad sheets which can be machined into an infinite number of simple or complex shapes.

BRAND-REX

A few minutes spent with samples and comprehensive Rexolite technical data will most surely be a profitable investment for you. Brand-Rex technical service engineers will gladly help, too. A note or call from you is all we need.

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XCELLENCE

XETER MANUFACTURING CO.

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As a reflection of its forward viewpoint and progressive attitude, Exeter's big E takes its place as a symbol of superior quality and excellence for the *complete* line of glass and cotton fabrics in the insulation industry. Important product and process improvements and prompt engineering and sales service have made Exeter the choice of the finest firms in America for over 130 years. May we help you?

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cy components requires that properties such as dielectric constant, dissipation factor, and dielectric strength be known with some degree of certainty at higher frequencies and temperatures.

"Electronic insulation suppliers should cooperate by providing this data and maintaining it up-to-date. Moreover, the availability of a single source reference for this information would greatly assist the materials engineer in selecting high frequency insulation. By way of a suggestion, *Insulation* magazine could render a service to the electronics industry by acting as the data clearing house and publishing periodically a table of high frequency dielectric properties."

L. Guido

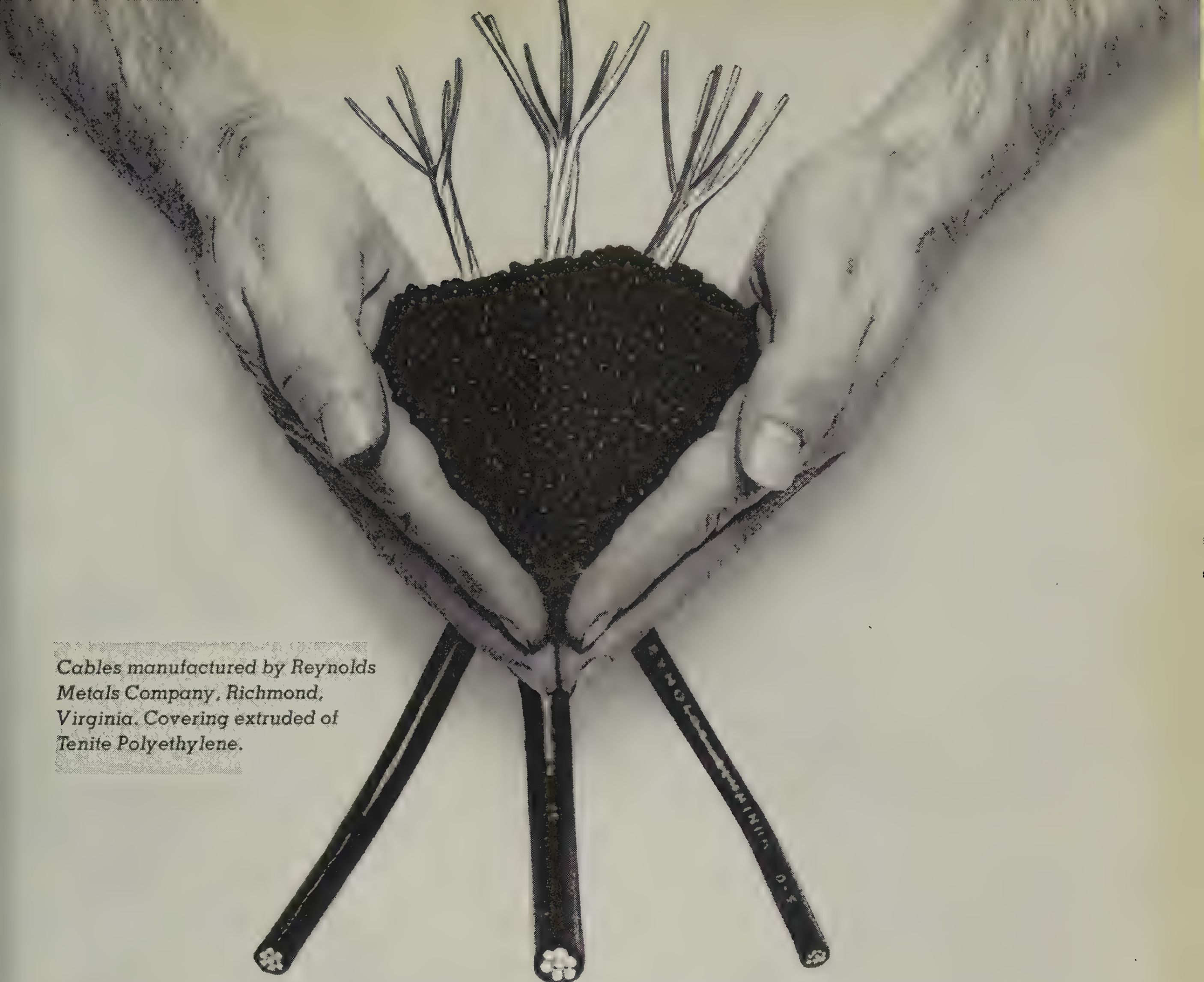
Standards Analyst, Ryan Electronics Div., Ryan Aeronautical Co. Inc., San Diego, Cal.

"There are many suppliers who could furnish more detailed information in all areas regarding insulation materials. In my experience, I have found that when I request specific information I invariably receive general statements and/or nominal and average values. Further contacts—which take a great deal of time—are then necessary.

"I have listed below some of the areas in which I believe more detailed information should be furnished:

1) Operating Temperature: It is desirable to have the range given and the preferred continuous operating value instead of just the plus or maximum value. The supplier who states, 'Can be used intermittently at higher temperatures,' should clarify his use of the word *intermittently*.
2) Cure Temperature: At least two or three temperatures should be given and the preferred value should be indicated.
3) Condition of Material: Is the material rigid, semirigid, or flexible

Print Ins. 13 on Reader Service C



Cables manufactured by Reynolds Metals Company, Richmond, Virginia. Covering extruded of Tenite Polyethylene.

Why Reynolds covers these aluminum conductors with TENITE POLYETHYLENE

To obtain the highest possible performance from their secondary distribution and service line cables, Reynolds Metals Company chooses Tenite Polyethylene as a covering material.

Tenite Polyethylene is manufactured under as rigid a system of quality control as Reynolds' own aluminum conductors, and makes a tough, weatherproof, fast-stripping covering material which offers high dielectric strength and resistance to abrasion, heat, moisture, chemical attack and stress cracking. It remains flexible even at sub-zero temperatures and its light weight permits easy handling and wide spans. Users report that it gives long service life without festooning or splitting.

Tenite Polyethylene is easily extruded as jacketing or insulation for many diverse applications, from coaxials to control cables, from TV lead-ins to telephone wires. For a material with outstanding electrical, physical and chemical properties, specify Tenite Polyethylene. For further information, write Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, Kingsport, Tennessee.

Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers in a unique spherical pellet form which flows freely in the extrusion process and in "air-veying" of bulk shipments from truck to bin.

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at room temperature?

4) Heat Distortion Point: It is desirable is some applications to predict behavior of rigid plastic sheet at elevated temperatures.
5) Shrinkage: Require the maximum value.
6) Moisture: List the percentage and indicate the insulation resistance retained.
7) Insulation Resistance: Always indicate the minimum value.
8) Self-Extinguishing: Give complete details.
9) Others: Dielectric strength, exotherm reaction, hardness, salt spray, etc.

"These items were touched upon very lightly to bring out some of the more important parameters. They are just a small sample of what the supplier could and should furnish. He will, in the future, find that more and more customers will require complete information and in greater detail.

"There are many specification sheets published which sound terrific. But when a sample is acquired and time and effort (money, too) is taken to test it, the product does not always prove itself as indicated in the specification. Suppliers should refrain from giving out half truths or inadequate information and give all the information, in detail, to the inquirer the first time. When a specification sheet is published it should contain all known data in minimum and/or maximum values and the particular test method used.

"I personally believe that most suppliers should standardize on the test methods used; preferably to a Military, Federal, or ASTM specification. It is also important that they publish these, or other methods, with each specification of their products.

"I sincerely hope that more suppliers will publish specifications of their products (old and new) with greater detail on values and specific test methods by which these values were obtained."

George F. Chadwick

Research Chemist, Research and Development Laboratories, Speer Carbon Co., Niagara Falls, N.Y.

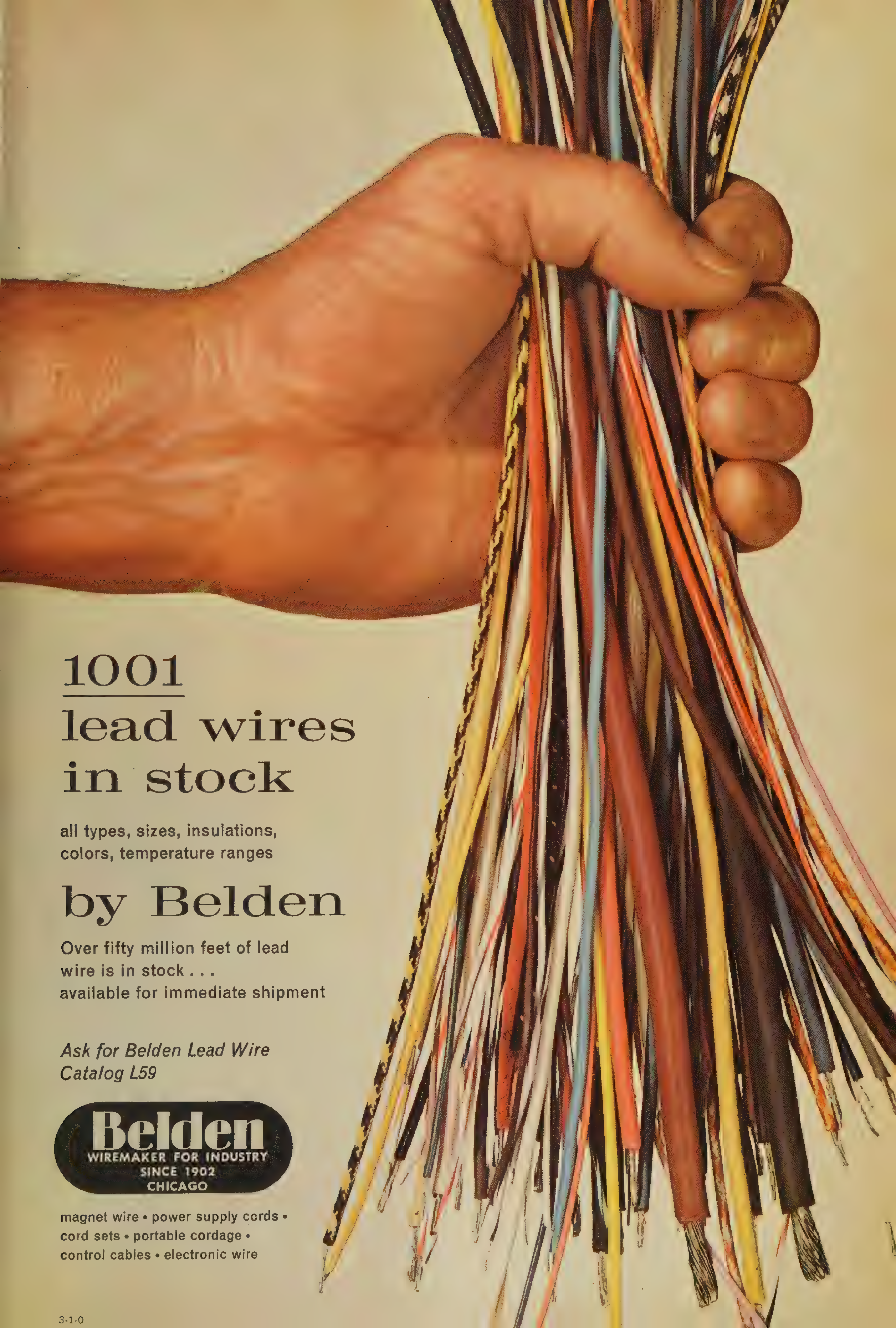
"In our search for better polymers for use in our electronic component maufacture, we are often hampered by the lack of test data available for resins and resin systems. This is especially true when we investigate resins which seem to have attractive features for us but that were not specifically designed for electronic applications.

"As a small company we cannot make a thorough study of each promising material and are forced to eliminate them by a preliminary screening. This task could be simplified if resin suppliers would supply a minimum of basic information for each of their materials. Besides the cure schedule, catalyst systems, and storage conditions, manufacturers might provide insulation resistance, water absorption, and perhaps flexural strength and maximum operating temperature. With these few basic properties intelligent screening would be simplified."

A. Higby

Chemist, Acme Electric Corp., Cuba, N.Y.

"Insulation materials of a wide variety are used here at Acme Electric —from kraft paper and organic varnishes for class A applications to modified silicone and ceramic insulations used on transformers operating at over 300°C. The data sheets we receive from the manufacturers of these materials usually provide general information, but quite often additional information of a more specific nature is needed and must either be obtained from the supplier or determined by ourselves. Some of this specific information is, no doubt, requested by enough people to warrant its inclusion on the regular data sheet. The one phase which would be of special value to me would be the various physical, chemical, and electrical properties at the recommended maximum use temperature of the material in question, such as short and long time dielectric strength, insulation resistance, compatibility with other materials, etc."



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Reveal Plans for Special Activities, Program, and Exhibitors at Insulation Application Conference

Officials of the Third National Conference on the Application of Electrical Insulation have announced near-complete details on the four-day technical and marketing program, names of exhibitors, and plans for special activities including the internationally important conference banquet. According to conference general chairman William Hoffer, Johns-Manville Corp., all attendance records are expected to be broken with an anticipated registration of well into the thousands for the meeting to be held December 5-8 at the Conrad Hilton Hotel, Chicago. Vice chairman in charge of commercial activities Michael Nakonechny, Dow Corning Corp., reports that increasing support from industry and improved planning for all functions have greatly strengthened the conference and its value to electrical/electronic insulation users.

The vice chairman in charge of technical activities, Roger White, The Glastic Corp., points out that the top-calibre, well-balanced technical program has been specifically designed to appeal to all types of insulation users—engineers, scientists, purchasing personnel, production supervisors, and management men are all being encouraged to take advantage of the many benefits offered by the conference. White also expects a considerable number of government workers, educators, utility men, and students to attend the conference. Papers to be presented at the meeting are listed in this article.

Commercial Exhibitors

Although exhibit space availability announcements were made only a short time ago, exhibit chairman Arnold Bohn, Dow Corning Corp., reports that only a few of the 135 exhibit spaces remain unsold and these are expected to be sold very quickly on a first come, first served basis. Exhibitors who have already been assigned one or more booth spaces include: American-Marietta Co., Associated Research Inc., Anaconda Wire and Cable Co., Atlas Asbestos Co., Bentley-Harris Mfg. Co., James G. Biddle Co., George C. Borthig Co. Inc., C-M Technical Publications Corp., Cincinnati Development & Mfg. Co., Chicago Printed String Co., Columbia Tape Mills Inc., Continental-Diamond Fibre Corp., John C. Dolph Co., Dow Corning Corp., E. I. du Pont de Nemours & Co. Inc., Federal Insulation Co., Formica Corp., General Electric Co. (Silicone Products Dept. and Insulation Materials Dept.), Exeter Mfg. Corp., Food Machinery and Chemical Co., Farley & Loetscher Mfg. Co., The Glastic Corp., J. J. Glenn & Co., Gudebrod Bros. Silk Co. Inc., Hays Mfg. Co., Hess, Goldsmith & Co. Inc., Hollingsworth & Vose Co., Hysol Corp., Insulation Manufacturers Corp., Johns-Manville Sales Corp., Lake Publishing Corp., Lenni Products Inc.

And The Macallen Co. Inc., Essex Wire Corp., L. Frank Markel & Sons, Meriden Molded Plastics Inc., Mesa Plastics Co., Minnesota Mining & Mfg. Co., Moxness Products Inc., Mycalex Corp. of America, L. P. Muller Co., National Vulcanized Fibre Co., New England Mica Co. Inc., Owens-Corning Fiberglas Co. Inc., Pennsylvania Fluorocarbon Co. Inc., Permacel, Permali Inc., Phelps Dodge Copper Products Corp., Polygon Plastic Co., Rayclad Tubes Inc., The Richardson Co., Riegel Paper Corp., St. Regis Paper Co., Spaulding Fibre Co. Inc., Special Electric Co., The Sterling Varnish Co., Stranco Products Inc., Suflex Corp., Synthane Corp., Taylor Fibre Co., Technical Tape Co., Rostone Corp., Silicones Div. of Union Carbide Corp., Varflex Corp., Westline Products Div. of Western Lithograph Co., and Westinghouse Electric Corp.

AIEE Lunch—Foreign Insulation

On Wednesday, December 7, the electrical insulation committee of the American Institute of Electrical Engineers is sponsoring a luncheon which will extend into a complete afternoon session devoted to foreign insulation practices. Luncheon tickets are priced at only $5. Guest speaker at the luncheon will be Professor Dr. Richard Vieweg, an insulation authority from Germany with an international reputation.

NEMA Dinner Open to All

The evening of Wednesday, December 7, the insulation materials division of the National Electrical Manufacturers Association is sponsoring a dinner which will be open to all manufacturers of insulating materials including both NEMA members and non-members. Ticket prices will be announced later. Guest speaker will be Major M. E. Griffith, Chief for Post Operations for the Air Force Ballistic Missiles Division's Hyper-Environmental Test System 609-A. He will talk on "The Applications of Electrical and Electronics Equipment in Missile Launching." He is the author of several papers on the effects of nuclear radiation on insulating materials.

Conference Banquet And Golden Omega Award

More than 1,000 diners are expected to fill the Grand Ballroom of the Conrad Hilton Hotel the evening of December 6 to hear a news-making speech by one of the country's leading industrialists. Toastmaster will be C. B. Burnett, president, Johns-Manville Corp. Musical interludes will be handled by contingents from the U. S. Naval Training Center, Great Lakes, Ill., and a commercial orchestra. The banquet will also be the occasion for the presentation of the Golden Omega Award to a scientist or engineer responsible for significant technological achievements of world-wide importance. Last year's award went to Vice Admiral Hyman Rickover, USN. The recipient of this year's award is presently being selected by a committee of distinguished industrial leaders. Banquet tickets will again be priced at $15 each.

Plant Tours, Registration, And Hotel Reservations

A number of plant tours to electrical and electronic installations and manufacturing firms are being arranged for Monday, December 5, and Wednesday, December 7. Details will be announced in a future issue.

Registration for the conference can be made in advance by contacting A. J. Wiltjer, Union Carbide Corp., Silicones Div., 230 N. Michigan Ave., Chicago 1, Ill. Registration fee is only $15 which permits attendance at all technical sessions and covers the cost of the preprint book of technical papers.

Hotel reservations should be made directly with the Conrad Hilton Hotel, Michigan Ave. and Balbo Dr., Chicago, mentioning the conference.

Conference Appointments

At a meeting last month of the executive committee, a nominating committee was appointed to nominate the chairman, two vice chairmen, and two executive committee members who will serve after the 1960 conference. Nominating committee members are Kenneth Mathes, General Electric Co.; Charles Leape, Westinghouse Electric Corp.; and Lincoln R. Samelson (Chairman), *Insulation* — they will report at the September 13 meeting of the general conference committee.

It has also been announced that Lincoln R. Samelson has been named local arrangements committee chairman replacing A. S. Gray who has found it necessary to devote additional time to his new duties as general manager of The Macallen Co. and Insulation Manufacturers Corp.

Outstanding Program

Under the direction of program chairman Thomas Hart, Silicones Div., Union Carbide Corp., an outstanding four-day program has been developed. There follows a tentative and partial listing of the papers presently scheduled to be presented—naturally this program is subject to change and further expansion. The complete, up-to-date final program will be published in the December issue of *Insulation.* In the listing, the names which immediately follow the session titles or themes are those of the session directors and session managers, respectively.

Monday Morning—Dec. 5

Class F Systems for Medium A-C Rotating Equipment

E. W. Sommers, Westinghouse Electric Corp., and E. J. Snyder, Bentley-Harris Mfg. Co.

Review of Class F Systems, E. W. Sommers, Westinghouse Electric Corp.

Flexible Insulating Papers, R. C. Berry, Rogers Corp.

Class F Sheet Insulation, Lloyd Smith, New Jersey Wood Finishing Co.

Wire Insulation for Class F Systems, R. H. Hall, Phelps Dodge Copper Products Corp.

Functional Evaluation of Class F Insulation for Rotating Machinery, A. J. Sherburne, General Electric Co.

Progress in Switchgear Insulation

D. D. Bergh, General Electric Co., and A. J. Briggs, Continental-Diamond Fibre Corp.

Progress in Switchgear Insulation, D. D. Bergh, General Electric Co.

Title to be Announced, W. K. Anderson, Commonwealth Edison Co.

An Analysis of Insulation Requirements for Metal Clad Switchgear, Warren Donaldson, General Electric Co.

Flame Retardant Laminates for Switchgear, H. V. Howe, Continental-Diamond Fibre Corp.

Compreg in Switchgear, E. T. Rogers, Permali Inc.

Electrical Circuit Connectors

R. F. Dorrell, Amphenol-Borg Electronics Corp., and Wilfred Lynch, Moxness Products Inc.

MIL-C-26500 Connectors, R. F. Dorrell, Amphenol-Borg Electronics Corp.

Title to be Announced, Galen Bley, Wright Air Development Center.

Insulating Systems for 600°F and 1000°F Aircraft Wire, R. W. Anderson and Allen Hubbard III, The Lewis Engineering Co.

Adhesives for Electronic Applications, Lawrence Krauss, Arma Div., American Bosch Arma Corp.

Epoxy in New Form Molding Compound and Machine Stock, Lloyd A. Dixon, Hysol of California.

Monday Afternoon—Dec. 5

Medium D-C Rotating Equipment

J. L. Kuelthau, Allis-Chalmers Mfg. Co., and Ward Hanson, Minnesota Mining & Mfg. Co.

Review of New Insulations, J. L. Kuelthau, Allis-Chalmers Mfg. Co.

Application Experience on D-C Motors by the U. S. Navy, W. H. Fifer, Bureau of Ships, U. S. Navy.

Evaluation of Commutator Bar Insulation, M. F. Gerkin, Continental-Diamond Fibre Corp.

Development and Evaluation of Insulating Systems for D-C Machines, W. B. Penn, General Electric Co.

New Class B Flexible Epoxy Resin Tapes, R. R. Charbonneau and P. L. Hedrick, Minnesota Mining & Mfg. Co.

Materials for Upgrading Temperatures For Controls

L. Mayeron, Minneapolis-Honeywell Regulator Co., and P. L. Hedrick, Minnesota Mining & Mfg. Co.

Materials for Upgrading Temperatures for Controls, L. Mayeron, Minneapolis - Honeywell Regulator Co.

Title to be Announced, A. B. Newton, York Corp.

Ultra-Fine Magnet Wires of Copper and Aluminum Open New and Challenging Field in the Electrical Industry, J. L. McKinley, Rea Magnet Wire Co. Inc.

High Temperature Epoxide Resin Formulution, J. S. Warburton and R. S. Norman, General Electric Co.

Laminated Mica—A New Insulation Material, E. G. Dingman, The Macallen Co. Inc.

Guideposts in the Application of Electrical Insulation

G. L. Moses, Westinghouse Electric Corp., and E. J. Phelan, Prehler Electrical Insulation Co.

The Purpose of Electrical Insulation, G. L. Moses, Westinghouse Electric Corp.

Electrical Insulating Materials, Gordon Gainer, Westinghouse Electric Corp.

The Fundamentals of Insulating Transformers, M. L. Manning, South Dakota State College.

The Fundamentals of Insulating Motors, Robert Kaplan, The Louis-Allis Co.

The Fundamentals of Insulating Electronic Equipment, K. G. Lagerlof, Raytheon Co.

Tuesday Morning—Dec. 6

Large Motors and Generators

E. S. Yates, and P. A. Goodwin, General Electric Co.

Large Motor and Generator Insulation, E. S. Yates, General Electric Co.

Silicone Rubber Insulation Systems for Rotating Apparatus, R. A. Ward, General Electric Co.

Insulating Systems for Large Motors and Generators, W. L. Marshall, General Electric Co.

Low Viscosity Epoxy Resins, John Delmonte, Furane Plastics Inc.

Low Frequency Testing of Insulation Systems, T. N. Bosworth, General Electric Co.

Application and Evaluation of Transformer Insulating Materials

H. G. Zambell, Allis-Chalmers Mfg. Co., and F. M. Di Cerbo, Sterling Varnish Co.

Application and Evaluation of Transformer Insulating Materials, H. G. Zambell, Allis-Chalmers Mfg. Co.

Title to Be Announced, A. S. Mickley, Philadelphia Electric Co.

Corona-Free Structures for Dry Type Transformers, W. H. Mutschler, Jr., Allis-Chalmers Mfg. Co.

An Evaluation of Insulation with Improved Thermal Resistance for Oil Filled Transformers, E. R. Waitt, Spaulding Fibre Co. Inc.

A New and Improved Heat Stabilized Insulation, T. K. Sloat, Westinghouse Electric Corp.

Class H Transformerette Tests on New Barrier Insulation, Herbert W. Dornbush, Pennsylvania Transformer Div., McGraw-Edison Co.

Thermal Endurance of Electrical Insulation

H. K. Graves, New York Naval Shipyard.

Insulation Life Comparison, Components Versus Systems, H. R. Sheppard, Westinghouse Electric Corp.

Thermal Classification of Pressure-Sensitive Adhesive Tapes, R. E. Hudrlik and W. M. Hanson, Minnesota Mining & Mfg. Co.

Thermal Aging of Enameled Wire and Insulating Varnish, D. L. McClenahan, Schenectady Varnish Co. Inc.

Overload Resistance of Film Insulated Magnet Wire, R. V. Carmer and E. W. Daszewski, Essex Wire Corp.

Wednesday Morning—Dec. 7

Repair and Maintenance of Rotating Equipment

D. E. Stafford, National Electric Coil Co., Div. of McGraw-Edison Co., and C. J. Herman, General Electric Co.

Repair and Rewinding of Rotating Equipment, D. E. Stafford, National Electric Coil Co., Div. of McGraw-Edison Co.

Maintenance Testing of Rotating Machinery as an Insulation Development Tool, J. C. Botts and J. S. Johnson, Westinghouse Electric Corp.

Use and Application of Insulation in Modern Electrical Repairs and Service of Rotating Machinery, J. M. Jenkins, Reliance Engineering & Mfg. Co.

Use of Magnet Wire in Repair of Motors and Generators, R. H. Hall, Phelps Dodge Copper Products Corp.

Maintenance and Maintenance Testing of Electrical Equipment, K. J. Dahl, General Electric Co.

Electrical Insulation Evaluation

N. W. Edgerton, Johns-Manville Corp.

More Rapid and Reliable Track Testing Techniques, G. R. Mitchell, The Glastic Corp.

An Interpretation of Arc and Track Resistance Methods by the Power Density Concept, H. R. Sheppard, Westinghouse Electric Corp.

Functional Evaluation of Mica Products, H. C. Lauroesch, General Electric Co.

Evaluation Procedure for Electrical Insulating Varnishes, C. F. Hofmann, Westinghouse Electric Corp.

Critical Evaluation of the Accuracy and Reliability of Enameled Wire Tests, R. S. Young, General Electric Co.

Computers

O. D. Black, Radio Corp. of America, and Ray Brock, The Richardson Co.

Printed Circuitry, O. D. Black, Radio Corp. of America.

Printed Circuits, Joseph Monturo, Arma Div., American Bosch Arma Corp.

Protective Coatings for Printed Circuit Boards.

Physical and Electrical Properties of Glass Reinforced Laminates as Affected by the Finish, E. L. Lotz, Glass Fabrics Finishing Co.

Capacitance Change in Printed Circuits, George Nolton, National Vulcanized Fibre Co.

(Continued next page)

NEW PRECISION TAPES SOLVE ELECTRICAL INDUSTRY PROBLEMS

Solve insulating, bonding problems with SCHJELBOND THERMOPLASTIC TAPES

Schjelbond tapes combine an extremely strong bond with high dielectric strength. Manufactured to close dimensional tolerances, and with high electrical purity, they meet the most exacting standards.

SCHJELBOND 100—.0025" thick Polyester dry strip adhesive **without backing.**

SCHJELBOND 300—"Mylar"* backing, adhesive coated on **one side.**

SCHJELBOND 400—"Mylar" backing, adhesive coated on **both sides.**

(Schjelbond 300 and 400 available with precise adhesive thicknesses from .0002-in. to .003-in., on .005-in. to .010-in. "Mylar".)

DIELECTRIC STRENGTH—"Mylar" rated at 4000 volts/mil.

BONDS—"Mylar", iron, steel, copper, glass, aluminum, wood, paper, cotton, silk, linen, nylon, wood fabrics, phenolics and ferrites.

SPECIAL LAMINATIONS, "Mylar" to "Mylar," are available.

SCHJELBOND ADHESIVE is also available with "Teslar" and other backing materials on special order.

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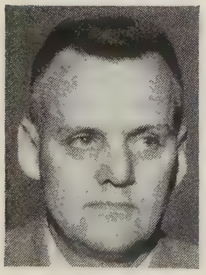

Our company is organized so we can move quickly to solve your problems. We have made many special laminations using Schjelbond for manufacturers of electric and electronic equipment. Our tape is suitable for many insulating jobs—from coil windings to flat cable.

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Wednesday Afternoon—Dec. 7

Foreign Electrical Insulation Practices

G. L. Moses, Westinghouse Electric Corp.

Papers have been invited from leading companies in Sweden, Germany, England, and Switzerland.

Molecular Key to Electrical Insulation Properties

A. E. Javitz, C-M Technical Publications Corp.

Introduction, A. E. Javitz, C-M Technical Publications Corp.

The Need to Know, N. B. Bashara, The University of Nebraska.

The Molecular Blocks of Insulating Materials, Jack Swiss, Westinghouse Electric Corp.

The Relationship of Molecular Structure to Properties of Gaseous and Liquid Dielectrics, H. B. Pfeiffer, General Electric Co.

The Relationship of Molecular Structure to Properties of Solid Dielectrics, Charles R. Vail, Duke University.

Molecular Consideration in Selection of Composite Insulating Materials and Insulating Systems, A. J. Warner, Aerovox Corp.

Missiles and Guidance Systems

Kenneth Mills, Martin Co., and M. L. Lewis, Permacel.

Papers and authors for this session to be announced in future.

Thursday Morning—Dec. 8

Marketing Program

E. J. Phelan, Prehler Electrical Insulation Co.

How to Introduce a New Product, A. L. Baldock, General Electric Co.

How to Make an Insulation Market Research Analysis, Charles P. Mills, Minnesota Mining & Mfg. Co.

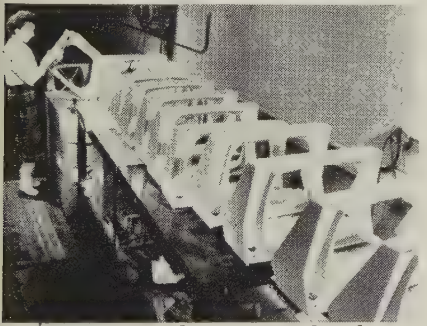
How the Customer Should Treat the Salesman, Thomas Keegan, Federal Insulation Co.

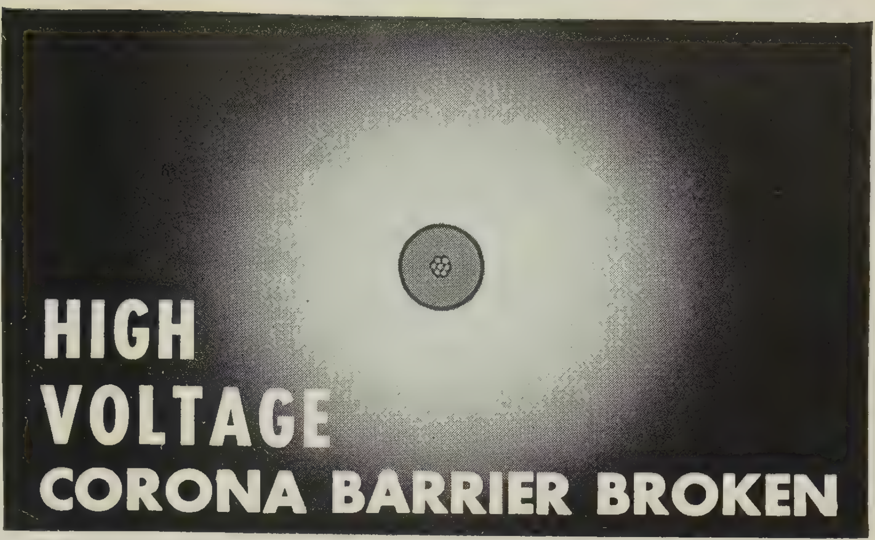
How Not to Sell Insulation, Robert E. Joseph, Allis-Chalmers Mfg. Co., William Carlstrom, Insulation Manufacturers Corp., and W. R. Swenson, Minnesota Mining and Manufacturing Co.

Insulation Helps Use of Styrene in TV Cabinets

According to Union Carbide Plastics Co., the plastics industry is about to recapture the television cabinet market which it lost 10 years ago, partially because of electrical insulation problems. Phenolic, the first synthetic plastic, captured much of the television cabinet market in the late 40's. As the design engineer increased the size of the screen from 8 inches to 21 inches, the larger cabinets required heavy expenditures for equipment to mold phenolic. The material lost an economic battle to steel. And for expensive, decorator sets, it lost an esthetic battle to wood. Within a short time, producers wrote off a 20-million-pounds per year market for phenolics. But the next two design changes put plastics back in the running again. These two changes—which are still evolving—were (1) the development of portable television sets and (2) major reductions in cabinet sizes. Cabinets of today's 21-inch sets are smaller overall than the 12-inch set of ten years ago.

With the portable television set came special problems in electrical insulation. One approach to this problem is the use of a heavy, insulating coating of vinyl on a steel cabinet. The smaller size of the cabinet placed the portable set within range of a wholly new concept; instead of the thermosetting phenolic, or the hard-to-form wood or steel, they could take advantage of the fabricating qualities of the thermoplastic styrene. With one material, the engineer could provide light weight, unlimited color possibilities, good insulation of the electrical components, and lower fabricating costs. High impact styrene reportedly is expected to be the standard material on virtually all portable television cabinets within a short time.





HIGH VOLTAGE CORONA BARRIER BROKEN

NOW TEFLON CAN BE USED FOR HIGH VOLTAGE CABLES

"POWER LINE PERFORMANCE IN HOOK-UP WIRE SIZE"

Now a patented process of laminating Teflon tape with a high dielectric oil reduces the incidence of corona by excluding air from the dielectric and protects the Teflon from damaging effects should corona occur. The graph below illustrates the long life of Teflon film in oil vs. that in air.

Corona is the result when a void (between the conductor and the insulating material or within the insulation) is subject to an ionizing potential. Extruded Teflon is susceptible to separation from the conductor when flexed because of its rigidity and solid mass. Solid Teflon by the very nature of its fabrication contains minute voids within its cross-section. These voids and separations are corona forming points, and without protection the Teflon is subject to deterioration, which degrades the cable.

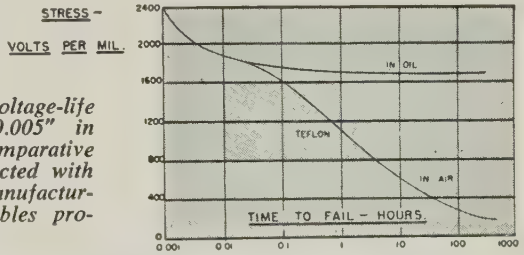
BIW uses thin Teflon tapes, so that any void within the tape is extremely limited in size. In addition, the tape is surrounded with a viscous high temperature — high dielectric oil which fills these voids. Through these techniques, BIW offers a flexible cable with the highest corona threshold in the smallest size.

Braided or extruded jackets are available. FEP 100X extruded Teflon jackets are resistant to acids, alkalies, solvents, abrasion, ozone, ultra-violet, water absorption, oils, fluids, temperatures to 200°C and will not flow at temperatures up to 250°C. With this type jacket, the cable strips easily. It has no braids to leak at high voltage or fray when cut and prevents unravelling of taped dielectric.

BIW laminated Teflon tape and oil constructions demonstrate great reliability over a wide temperature range and are light in weight. Solid colors are available for color coding. These cables are particularly suited to high voltage, high altitude applications where corona is more prevalent. They are ideal for use in shielded cables where small diameter, high voltage leads must run next to ground. Other uses include power plant ignition, high temperature transformers, ignition wires for continuously operating internal combustion engines and chemical processing apparatus. They find wide application in missiles and rockets, electronic equipment, as well as for high temperature, high voltage generator leads and tube cap leads.

Send for the complete brochure — BIW Type HP (High Performance Cable). Your BIW representative will be happy to discuss this and any other wire and cable constructions with you.

Teflon is a product of DuPont



THIS GRAPH shows voltage-life tests of Teflon film 0.005" in thickness. Note the comparative long life of Teflon protected with oil. BIW process for manufacturing Teflon insulated cables protects with dielectric oil.

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Telephone: COlumbia 5-2104

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NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

	Copper & Copper Alloy Conductors				Aluminum Conductors	
Conductor Size AWG or Mcm	URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	230	105	87.4
4	155	170	163	143	73.3	53.3
6	103	115	108	91.5	51.5	35.0
Solid						
2	239	260	232	219	92.2	79.2
4	151	164	152	136	64.0	48.0
6	100	112	101	87	45.7	31.7

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean...free-stripping... has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits... when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous...tough...resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene...The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

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Evaluating a Specialty Transformer Insulation System by the Proposed AIEE Test Procedure

D. S. Stephens, Westinghouse Electric Corporation, Greenville, Pa., and E. W. Lindsay, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Abstract

This article discusses the selection of the design of a test transformer and selection of a transformer insulation system to be used as a base line for comparison of future insulation systems. Also, the preliminary test on the test transformer prior to evaluating its insulation system by the proposed AIEE test procedure. Data are presented to illustrate the differences in thermal gradients through a transformer with various buck-boost loading circuits and with normal loading. Recommendations are made for the method of loading the transformer during the thermal aging portion of the test procedure. Temperature life data obtained by the proposed AIEE test procedure are also presented for an insulation system that will be used as a base line for comparison of experimental insulation systems.

Introduction

Why is there considerable discussion and a great deal of concern over the life of insulation used in electrical machinery? Why not make a transformer large enough to keep the temperature down to proven safe values and use plenty of insulation to avoid failures? The answers will become

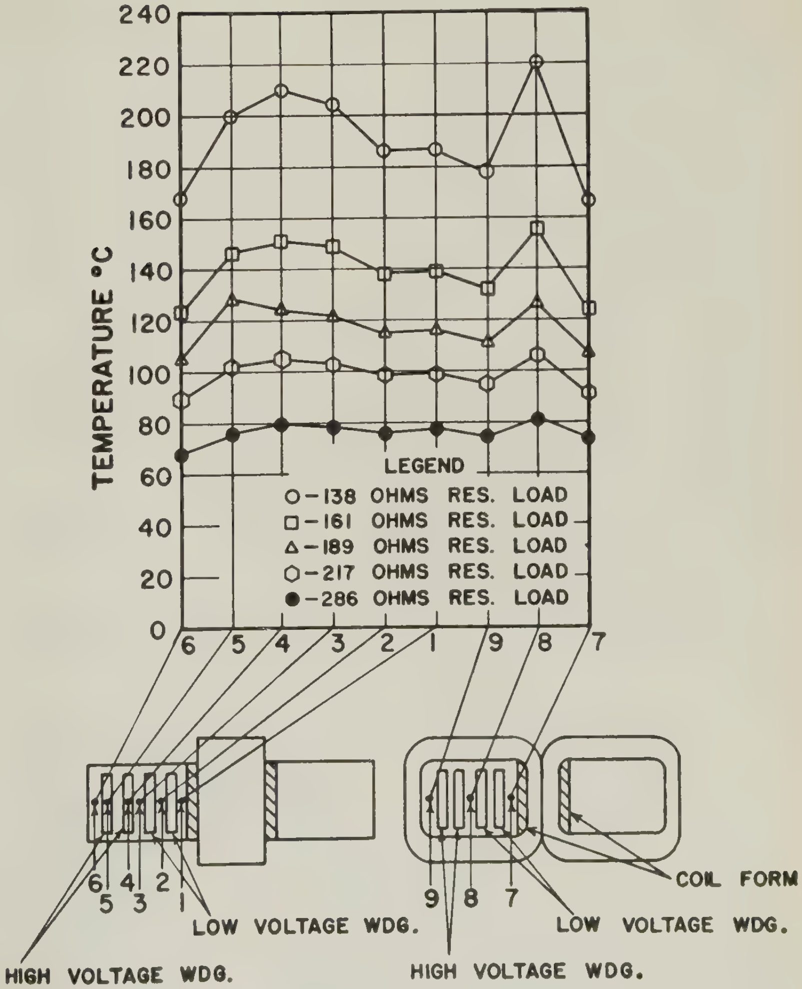
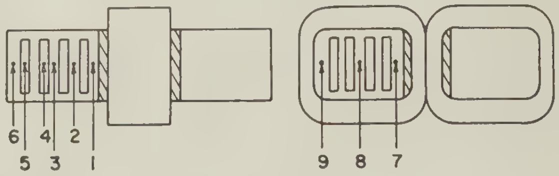


Figure 1, temperature distribution within a type "A" transformer under various resistance loads.

TABLE I
LOCATION OF THERMOCOUPLES



THERMOCOUPLE NUMBER	LOCATION
1	TUBE & FIRST LAYER
2	BETWEEN LV SECTIONS (MIDDLE OF SECTIONS)
3	BETWEEN HV & LV WIND (MIDDLE OF INS.)
4	HV WIND, BETWEEN 3&4 LAYER (OVER LAYER INS.)
5	HV WIND, BETWEEN 1 & 2 LAYER (OF 2 ND SECT.) OVER LAYER INS.
6	OVER LAST LAYER OF WIND. (UNDER OUTER WRAP)
7	SAME AS #1 (EXCEPT IN WINDOW AREA)
8	SAME AS #3 (EXCEPT IN WINDOW AREA)
9	SAME AS #6 (EXCEPT IN WINDOW AREA)

THERMOCOUPLE – INSULATED WITH #27 .007 THK. TAPE OVER AND UNDER TO OUTER EDGE OF COIL.

#1-2-3-4-5 WERE ALTERNATED 1/2" OFF CENTERLINE (BOTH SIDES)

ORDER OF THERMOCOUPLES #1-7-2-3-8-4-5-6-9

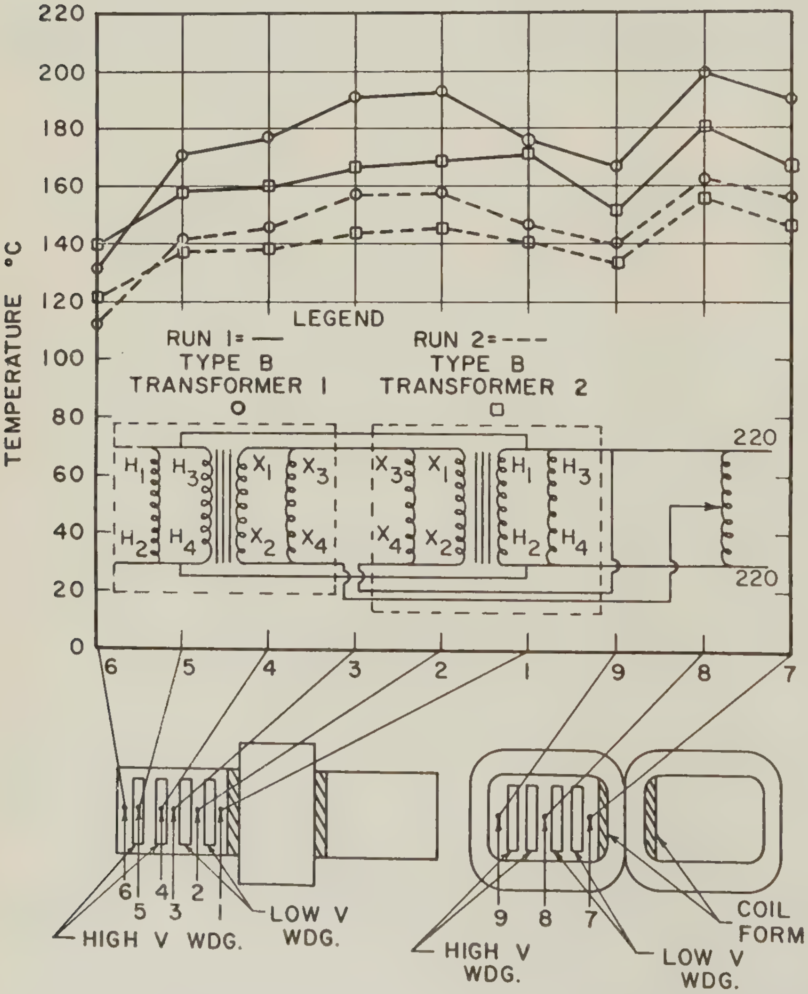


Figure 2, temperature distribution within type "B" transformer when standard method for loading transformers to determine temperature rise is used to heat transformers.

evident if the evolution of electrical machinery is reviewed. Years ago, a customer was satisfied if a transformer performed satisfactorily for a long period of time. Performance was of first concern; size and weight were hardly considered. One could always provide the required mounting area and a sufficiently strong mounting structure. As industry began to take satisfactory performance for granted and as competition arose between manufacturers, the customer began to look for factors other than performance for buying. The next logical factors were size, weight, and cost. The slow but continual increases in labor and material costs spurred the development of smaller and lighter transformers. As improvements in electrical steel began to level off or hit plateaus, the minimum insulation needed and the operating temperatures began to be studied. Less insulation and high temperature capabilities give immediate size and weight reductions. Thus, manufacturers immediately found themselves in a field of activity where knowledge of life versus temperature became of prime importance. Therefore, as a guide to designers, the AIEE classified insulating materials according to their chemical compositions into various temperature classes.

The development of new combinations of heat resistant materials and treated materials, the serious study of service conditions, and the question of life expectancies of various types of electrical machinery have made it necessary to reconsider the AIEE classifications and associated temperature rises of insulation materials as originally defined. From this consideration, a concept has evolved whereby the temperature rating of electrical machinery is based on life expectancy arrived at by extrapolating results of functional evaluation tests on the equipment. Under this concept, the performance of the complete insulation system, in controlled tests, is used in determining the temperature rating, rather than using the chemical composition of the insulation components, as was formerly the case. This permits newly developed heat stable insulating materials to be used at temperatures nearer the maximum capability of the insulation system rather than limiting the operating temperatures by the chemical composition. This also provides a rapid method of evaluating insulation systems within the equipment. In effect, this permits new insulating materials to be used in production equipment more rapidly. This is essential since it is not practical to wait for a new insulation system to be proven by years of field service.

In order to properly use this new concept of functional evaluation of insulation systems, it is necessary to establish a base line of life versus temperature for a known insulation system. This known system must be one which has enjoyed satisfactory service in the field for many years. This base line can then be used for comparison purposes with new or other insulation systems. This report discusses the selection of the test transformer, preliminary tests prior to life evaluation tests, and recommendation of transformer design. Life-temperature data obtained from the selected transformer is also presented.

Selection of Test Transformer

The transformer selected for this evaluation was a general purpose specialty transformer having an insulation system which has been used for approximately 50 years and has a proven satisfactory life. Basically, the insulation components were enameled wire, paper covered wire, kraft paper, fish paper, pressboard, Micarta, and the coil form, with the complete assembly vacuum impregnated with an alkyd resin. These are so-called class A materials. The design was for operation in air at 105°C maximum temperature. The core-coil assembly was enclosed with a weather proof metal case. Cooling was accomplished by transfer of heat to the case surface by conduction and the internal convection currents of air. Such a basic design of transformer, or modifications, has been made by many manufacturers and used on an industry-wide basis.

To load specialty transformers by a buck-boost arrangement, it is advantageous to have a transformer with a multiple winding configuration. This permits the trial of more combinations of windings in a bucking arrangement and increases the possibility of finding a buck-boost arrangement which will approximate the temperature gradients through the transformer under normal load. The transformer selected had four windings with a 240 x 480 volt to 120/240 volt ratio and was rated at 750 kva, 60 cycles.

Preliminary Tests

Before testing the selected transformers on life test, it was necessary to determine the hot-spot temperature, the method of loading while on test, and the test cycle for the particular type of transformer. In order to determine the hot-spot within the transformer, a number of transformers were built, each containing nine thermocouples spaced throughout the

TABLE II

COMPLETE TEST CYCLE FOR THE FUNCTIONAL EVALUATION OF SPECIALTY TRANSFORMERS FOR OUTDOOR APPLICATION

STEP	REMARKS
1. TEMPERATURE AGING VOLTAGE STRESSING AND THERMAL SHOCK	FOUR 24 HOUR PERIODS CONSISTING OF 20 HOURS AT TEMPERATURE WITH VOLTAGE STRESS AND FOUR HOURS TO COOL TO ROOM TEMPERATURE WITH VOLTAGE OFF, EACH 24 HOUR PERIOD.
2. MECHANICAL STRESS	VIBRATED AT 7g FOR 10,000 CYCLES AT ROOM TEMPERATURE AT A SELECTED FREQUENCY. (f=37.5)
3. THERMAL SHOCK	PLACED IN A COLD CABINET AT -20°C FOR 2 HOURS.
4. MOISTURE EXPOSURE	48 HOURS AT 100% R.H. PLUS CONDENSATION AT 5 TO 10°C ABOVE ROOM TEMPERATURE.

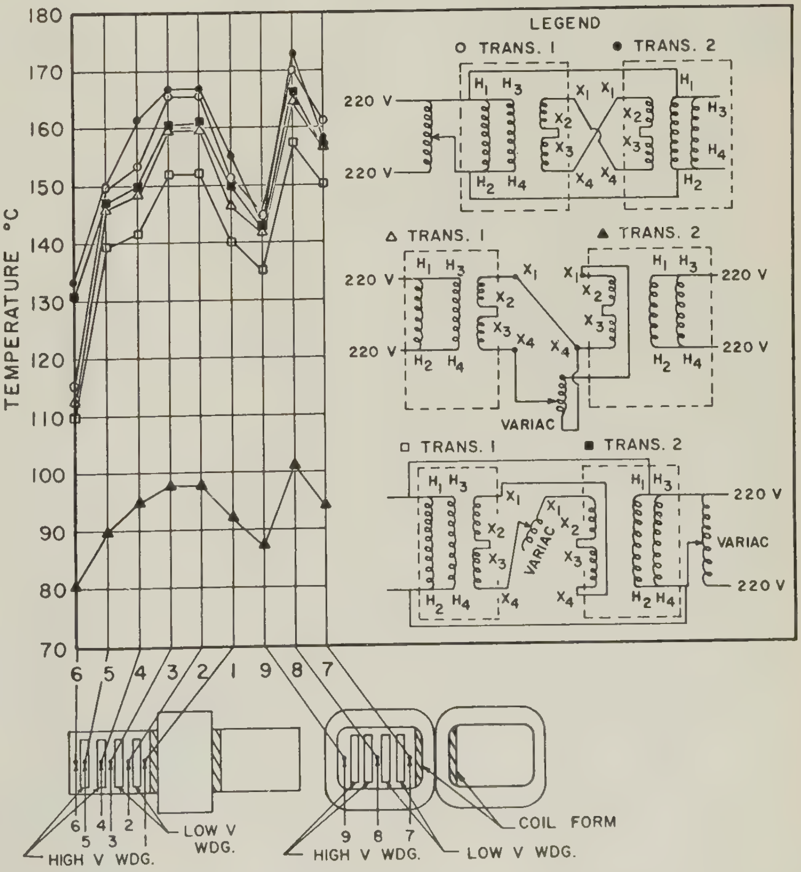


Figure 3, temperature distribution within type "B" transformers as influenced by various loading methods.

windings. (See table I for the location of the thermocouples within the winding.) Temperature rise tests with resistive loads were made on each of these transformers for the purpose of determining hot-spot and normal temperatures throughout the transformer. Figure 1 shows the temperature distribution within a transformer for five different resistive loads. All the units were tested under the same load conditions. The curves for the different loads are approximately parallel and show that each thermocouple is proportionately affected by a copper loss increment. As temperature distributions within the transformers are about the same, only the results from one transformer are presented. As can be seen from figure 1, thermocouple #8 located in the core window area in the middle of the insulation between the high voltage and low voltage windings was the hottest spot measured.

It would be possible and correct to conduct accelerated functional life tests on a general purpose transformer (or any specialty transformer) by operation with a resistive overload. However, to test a large number of units at one time by this means would require an excessive amount of power. The physical arrangement and cooling of the load resistors would be an expensive arrangement to achieve in a normal laboratory room. It would be difficult to prevent the heat dissipated by the load resistors from upsetting desired ambient temperature conditions. Hence, it is advantageous to have a transformer loading circuit for producing the desired transformer temperature wherein only the internal losses are supplied. A number of different connections were tried in order to find the best method of buck-boost loading. The standard ASA method for determination of temperature rise by operating two transformers in a buck-boost arrangement was tried and results are shown in figure 2. This resulted in temperature variations as high as 25°C between identical units for the same thermocouple location. This was sufficient evidence to prove that individual load control of each transformer is necessary during an insulation life test. Also, it ruled out the use of the standard ASA method.

A number of other connections using buck-boost arrangements between two transformers were tried, but all methods resulted in the problem of temperature differential between the two units. The results from a few of the connections are given in figure 3. Since poor results were obtained with two transformers in a buck-boost connection, the various windings within one transformer were connected in a buck-boost arrangement. The connection that produced temperature gradients through the transformer closest to a normal load condition was the one which bucked the two secondary windings X1-X2, X3-X4 in series against H3-H4 and using H1-H2 for excitation. Some of the results of these tests, along with the results of operating a transformer normally under resistance load are plotted for comparison in figure 4. It is easily seen from figure 5 that with the best buck-boost connection, there are differences between the temperature distribution within the transformer when it is operated normally and in buck-boost. However, it is believed that these differences are not great enough to give misleading results if the transformer is aged in this buck-boost arrangement.

The #3 thermocouple location was selected for the monitoring thermocouple. This location is the same point

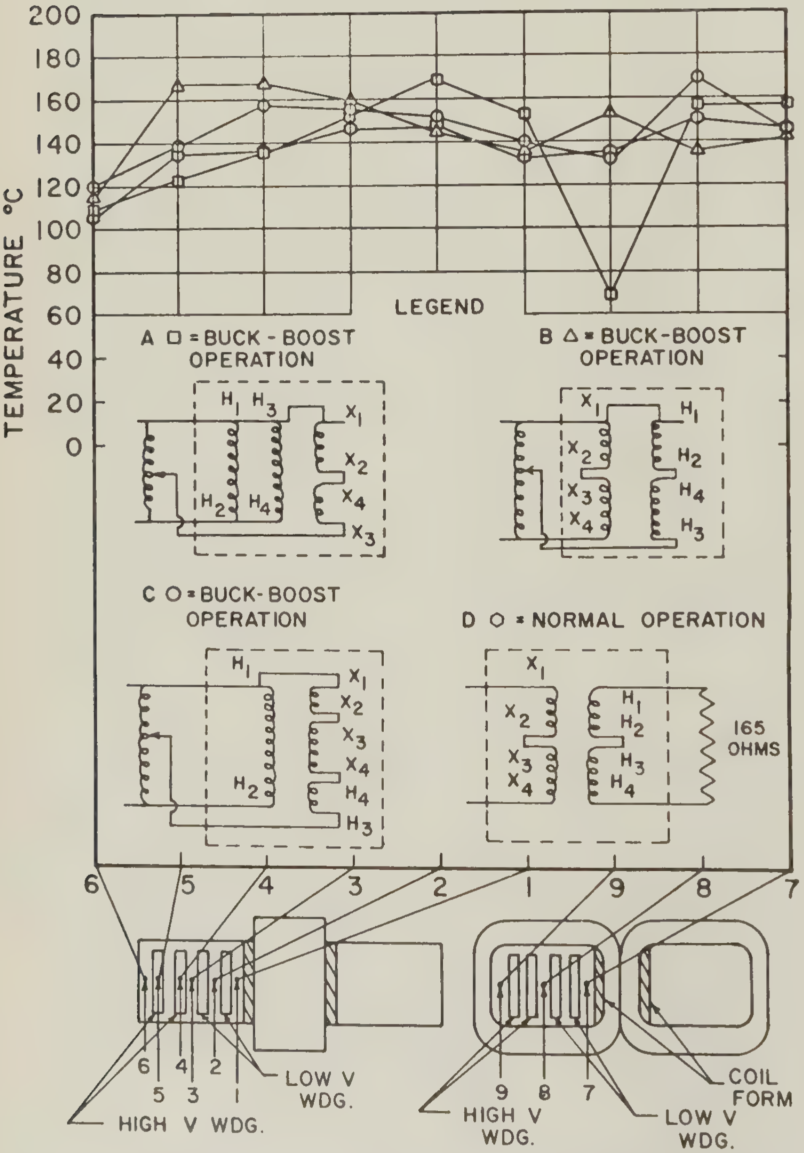


Figure 4, temperature distribution within type "B" transformer when operated under normal load and various buck-boost connections.

within the insulation system as the #8 thermocouple, or hot-spot location, except outside the core window. This location was chosen rather than the hot spot because of ease of installation. Two thermocouples were placed ½-inch apart at this location in each transformer. Sometimes thermocouples become defective during test which means the loss of a unit. The use of two thermocouples greatly reduces this possibility.

The test method used for this evaluation came from the proposed procedure formulated by the AIEE working group on "Application of Insulating Materials to Specialty Transformers." This procedure covers the evaluation of all types of specialty transformers for various applications. As the transformer chosen for this evaluation was an outdoor general purpose transformer, the environmental test which was followed was that outlined for outdoor units in the procedure. This test cycle is shown in table II. The buck-boost test circuit used for the temperature aging, voltage stressing, and thermal shock portion of the test cycle is shown in figure 6. The actual test stands incorporating this circuitry are shown in figure 7.

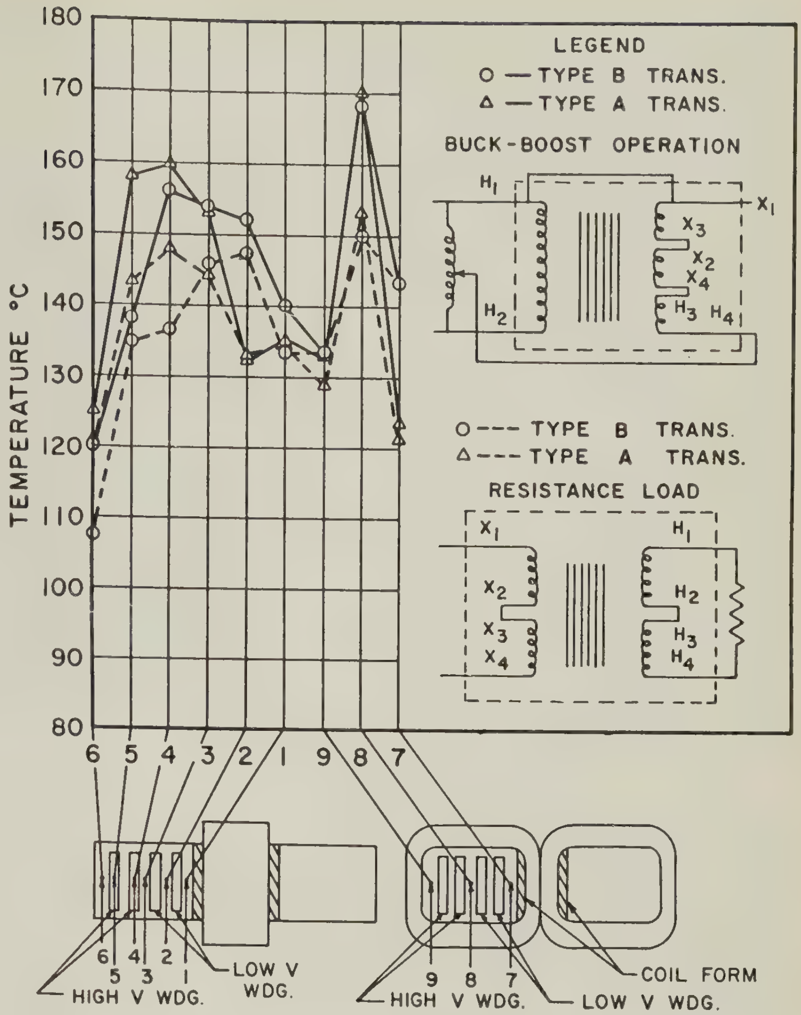


Figure 5, temperature distribution within transformer when operated under normal load and buck-boost.

Results of the Evaluation

Eighteen test transformers were tested at three test temperatures. Six of the units were thermally aged at a hot-spot temperature of 150°C, another six units were thermally aged at a hot-spot temperature of 170°C, and the third group of six were thermally aged at 190°C. As a transformer became inoperable during the temperature aging part of the test, the unit was removed and the hours of life recorded. These data were handled as outlined in the AIEE test procedure 1F.

Results of the transformer evaluation are shown in figure 8. This curve shows the linear regression line and the upper and lower 95 percent confidence lines. The points shown on the curve are the actual test data. Since the insulation system was class A, the life line was extrapolated back to 105°C. This life expectancy at 105°C under the conditions of the test procedure is 12,000 hours or approximately 1½ years. The lower 95 percent confidence limit line intersects the 105°C line at slightly under one year and the upper confidence limit line intersects at approximately 2½ years.

The life expectancy thus obtained reflects the accelerated nature of the thermal loading and environmental tests. This becomes more evident upon examination of the environmental conditions. The units were: 1) cooled to room temperature once every 24 hours, 2) once a week they were vibrated at 7G for 10,000 cycles, 3) they were thermal shocked at —20°C for two hours every week, and 4) for two days of every seven, they were subjected to 100 percent humidity with condensation at 5 to 10°C above room temperature. This program subjected the transformer to a severe environment during 40 percent of the total calendar time during which the tests were conducted.

It must be recognized that this life expectancy of the insulation system at its rated temperature as obtained by the test procedure is not necessarily the expected life of the insulation under normal operation. The life expectancy thus obtained is to be used only for comparison purposes. For example, the results of the system showed a predicted life of 12,000 hours at 105°C and this system is considered to have a 15 to 25 year field life. An insulation system with a predicted life of 24,000 hours will not necessarily have an anticipated field life of 30 to 50 years, but can confidently be expected to have a longer life than that of the 12,000 hour system.

The essential factor to be kept in

mind in evaluating the test results presented in this report is that the insulation system itself was not being evaluated. That is, the purpose of the test was not to establish the operating temperature of the system or to determine the rating of the test transformer. Both the operating temperature and the rating of the test transformer have been established and proven adequate by long usage.

The intent was to determine by means of the test procedure the time-life characteristics of the system when subjected to the temperature and environmental conditions of the proposed procedure. Since the system tested is a conventional class A system, proven by long-time usage, the life expectancy under the test conditions extrapolated to 105°C should be a "bench mark" or reference. Presumably, any other system subjected to the same test procedure would be expected to operate equally satisfactorily at that temperature, which would give the same life expectancy

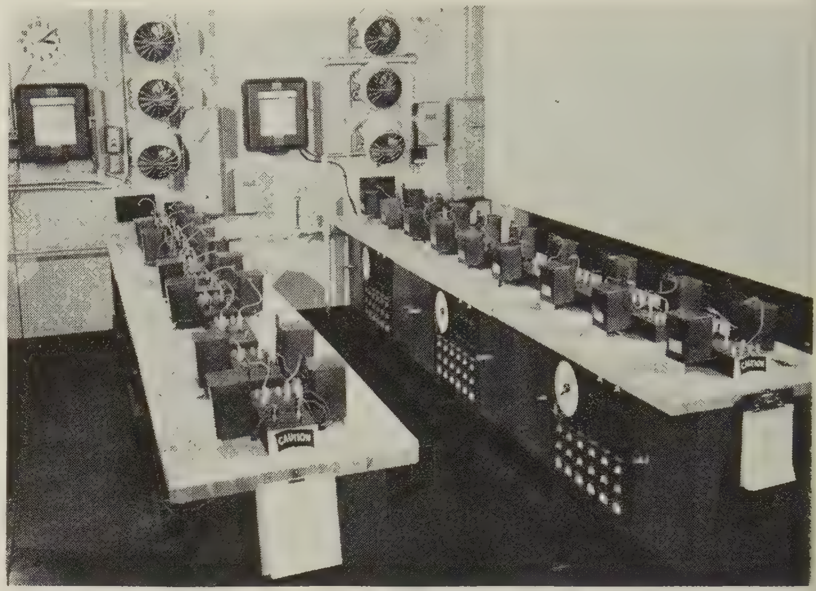


Figure 7, six transformer test stands for thermal aging of tranformers.

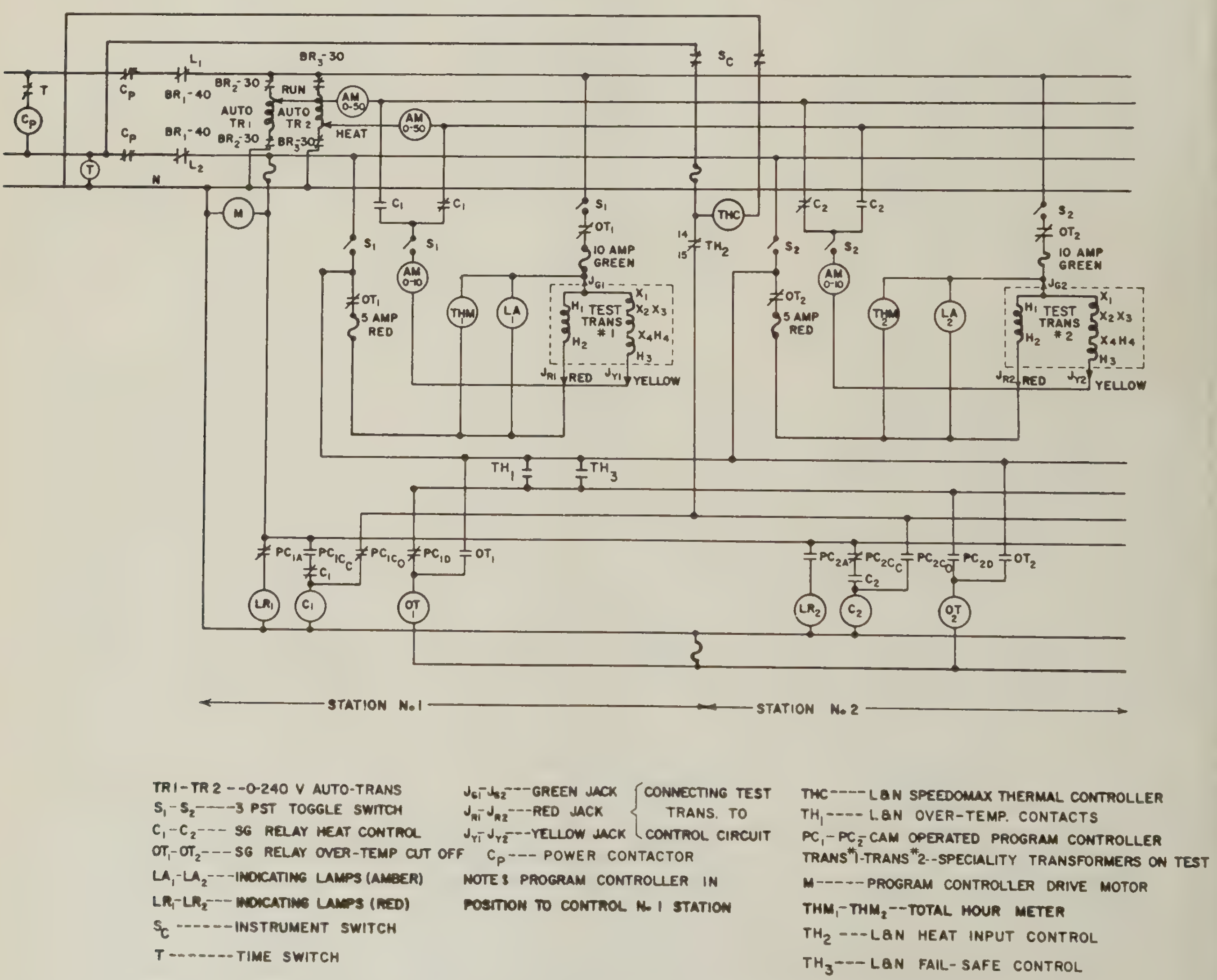

STATION No. 1
STATION No. 2
TR1-TR2 --0-240 V AUTO-TRANS
S_1-S_2----3 PST TOGGLE SWITCH
C_1-C_2--- SG RELAY HEAT CONTROL
OT_1-OT_2---SG RELAY OVER-TEMP CUT OFF
LA_1-LA_2---INDICATING LAMPS (AMBER)
LR_1-LR_2---INDICATING LAMPS (RED)
S_C ------INSTRUMENT SWITCH
T -------TIME SWITCH
J_{G1}-J_{G2}---GREEN JACK
J_{R1}-J_{R2}---RED JACK
J_{Y1}-J_{Y2}---YELLOW JACK
CONNECTING TEST TRANS. TO CONTROL CIRCUIT
C_P--- POWER CONTACTOR
NOTE: PROGRAM CONTROLLER IN POSITION TO CONTROL No. 1 STATION
THC----L&N SPEEDOMAX THERMAL CONTROLLER
TH_1---- L&N OVER-TEMP. CONTACTS
PC_1-PC_2-CAM OPERATED PROGRAM CONTROLLER
TRANS#1-TRANS#2--SPECIALITY TRANSFORMERS ON TEST
M-----PROGRAM CONTROLLER DRIVE MOTOR
THM_1-THM_2--TOTAL HOUR METER
TH_2 ---L&N HEAT INPUT CONTROL
TH_3---L&N FAIL-SAFE CONTROL

Figure 6, schematic diagram of control circuit for specialty transformer insulation evaluation test (2 of 6 stations shown).

as the reference system. Other existing and proposed insulation systems are under evaluation and the results to date substantiate the validity of the procedure for comparison purposes.

Conclusions

1. The environmental conditions imposed by the proposed test procedure are severe enough to produce an accelerated test.
2. The conditions of the proposed test procedure are such that the life in hours, for specified test conditions, fall within a practical and usable spread of values.
3. It is possible by using the proposed procedure to establish a relationship of life versus temperature for comparison of insulation systems.

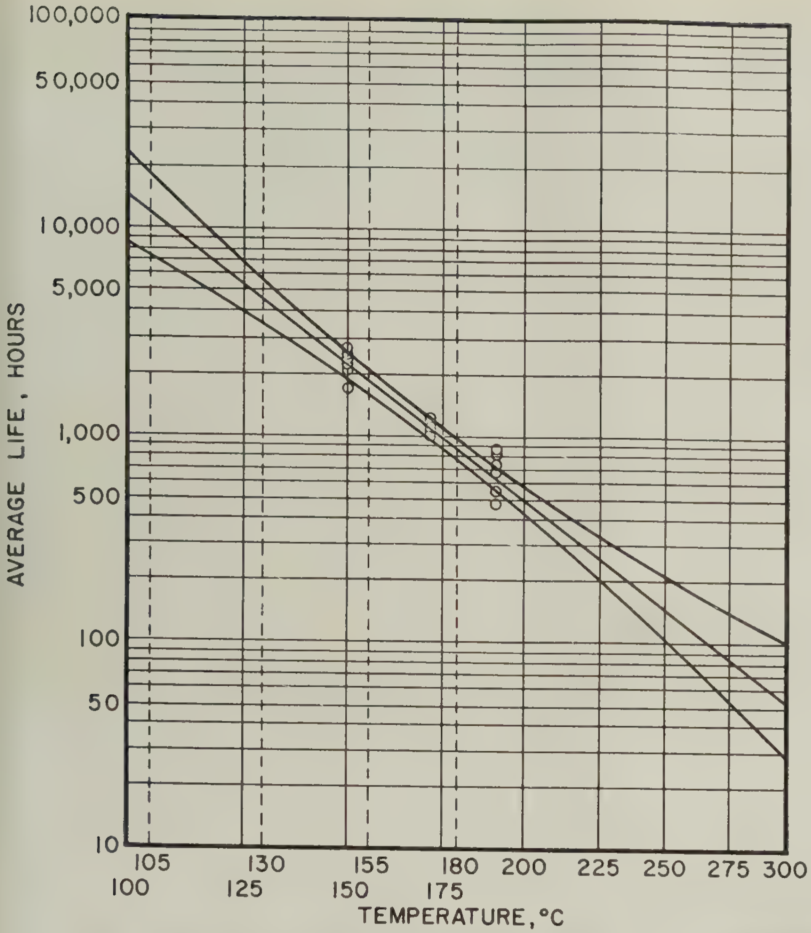


Figure 8, life vs. temperature for type "A" transformer as determined by the proposed AIEE test procedure for specialty transformers.

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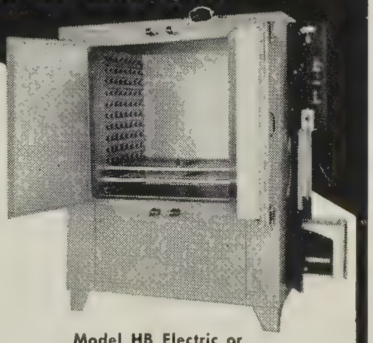

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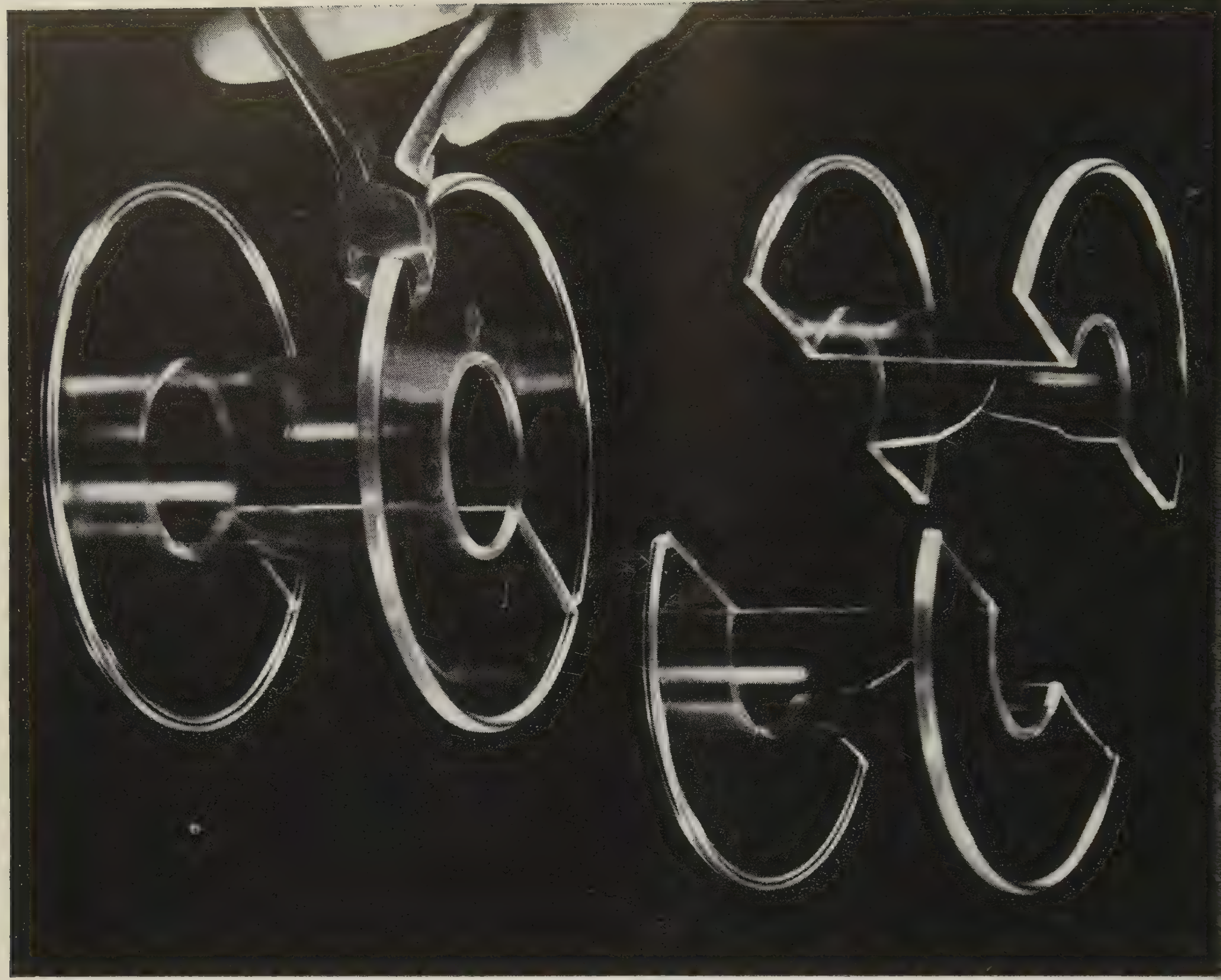

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Use of Low-Cost Foil-Clad Paper-Base Epoxy Laminates for Printed Wiring Boards

By Hugo L. Uglione Jr., The Martin Company, Orlando, Fla.

Introduction

Low-cost paper-base epoxy laminates are good, and for certain applications, superior to glass-base epoxy laminates, according to an extensive evaluation program recently completed at The Martin Company, Orlando, Fla., division. Accumulated test data showed that the paper base material met all the requirements of MIL-P-21466 with one minor exception—flexural strength. On the plus side, in addition to lower cost, the paper-base material was found to have advantages not possessed by glass-base material—lighter weight, improved machining characteristics, and a greater susceptibility to hole punching.

At The Martin Company, large quantities of glass-base laminates were being consumed in the manufacture of printed wiring boards. Paper-base laminates were available at approximately 25 percent less cost. Therefore, an investigation to determine the feasibility of substituting the new paper-base material for the higher cost glass-base material was in order.

A survey of the industry was conducted to determine the availability of copper-clad, paper-base epoxy laminates and four manufacturers were found. Production sheets 1/16-inch thick, clad both sides with two ounces of copper per square foot, were purchased from these four suppliers. For comparison purposes, 1/16-inch thick production sheets of NEMA grade G-10 glass-base epoxy were also purchased. At no time were laboratory materials or samples used in the tests.

Specific requirements for foil-clad, glass-base epoxy laminates are established by military specification MIL-P-21466, Plastic Sheets, Laminated, Copper-clad, Glass-base Epoxy. However, government specifications covering the newer paper-base material have not been released; therefore, MIL-P-21466 requirements were used as a reference point in the evaluation program.

A number of tests not covered by MIL-P-21466 were also made. When standard test procedures were available (federal specification L-P-406 or ASTM specifications), they were followed.

Flexural Strength

Flexural strength specimens and tests were conducted as specified by MIL-P-21466 and federal specification L-P-406, method 1031, using a span length of two inches. These tests showed that flexural strength of the glass-base laminate is approximately double that of the paper-base epoxy laminate. Tests for modulus of elasticity for flexure, compression, and tension, in accordance with ASTM specification E-111 were also conducted. Compression and flexure moduli were calculated using the slope of the initial straight line portion of the stress-strain curves. The tensile moduli were calculated by the secant method instead of the tangent method, since the curves had no initial straight portion. The modulus values for tensile, flexure, and compression of paper-base laminates are from 30 to 50 percent lower than those of glass-base epoxy laminates. Table 1 lists these properties.

Bond Strength

Copper bond strength specimens were then prepared as specified in MIL-P-21466. Figure 1 shows the

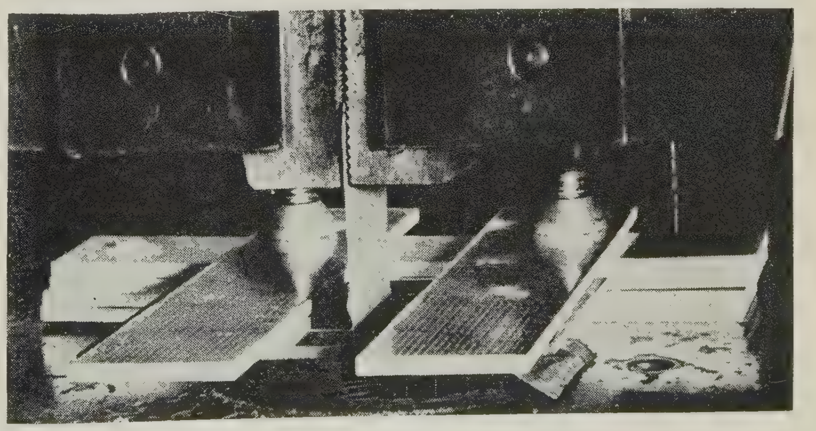


Figure 1, test set-up for copper bond strength.

Table 1 — Mechanical and Physical Tests

Mechanical and Physical Tests	Paper-Base Sample A	Paper-Base Sample B	Paper-Base Sample C	Paper-Base Sample D	Glass-Base G-10	MIL-P-21466 Requirements
Tensile Strength, yield, psi (.2% offset)	Ultimate	Ultimate	Ultimate	Ultimate	Ultimate	
Ultimate, psi	13,800	11,600	12,200	12,400	43,300	
Compressive Strength, Yield, psi (.2% offset)	17,600	17,700	20,600	21,900	Ultimate	
Ultimate, psi	28,700	25,600	29,000	30,600	62,300	
Flexural Strength, Lengthwise, psi	24,400	19,600	22,300	23,100		55,000 min.
Crosswise, psi	20,800	18,600	22,000	23,100		45,000 min.
Tensile Modulus, psi, $\times 10^{+5}$	7.00	7.25	9.10	11.50	21.80	
Compressive Modulus, psi, $\times 10^{+5}$	5.86	6.25	6.65	6.48	9.70	
Flexure Modulus, Lengthwise, psi, $\times 10^{+5}$	11.5	9.76	13.0	12.6	26.00	
Crosswise, psi, $\times 10^{+5}$	9.51	8.78	11.7	12.6	24.00	
Copper Bond Strength, lbs/inch						
As Received	14.4	15.7	15.8	14.4	8-12	
Solder Dipped	13.3	16.6	14.8	13.9		7 Minimum
After Elevated Temp.—1 hr/140°C	10.6	13.3	11.4	13.1		7 Minimum
After Temp. Cycling—(½ hr/85°C)+(¼ hr/23°C)+(½ hr/−55°C)+(¼ hr/23°C)	13.1	15.4	15.4	13.1		7 Minimum
Copper Thickness, inches	0.0024	0.0036	0.0034	0.0032		0.0028+0.0007 −0.0003
Water Absorption, %	0.472	0.379	0.476	0.399		0.50 max.
Specific Gravity 23/23	1.409	1.414	1.274	1.322	1.8	
Maximum Operating Temp., °F	338	338	338	338	338	
Flammability, inches/minute	SE*	SE*	0.727	0.467	0.703	
Warp, or Twist, %	1	1	1	1		1 Maximum

**Self-Extinguishing.*

test fixture used. The spacing between the coupon holders was such that the angle of pull was always within plus or minus 5 percent of normal. Copper bond strength was tested under four conditions as specified in MIL-P-21466:

1. As received.
2. After solder dipping.
3. After temperature cycling.
4. After elevated temperature cycling.

The copper bond strength of the paper-base epoxy laminates exceeds the minimum requirements of MIL-P-21466 for G-10 laminates (table 1). The government specification states that for a 0.062-inch laminate of two-ounce copper, the nominal thickness of the copper should be .0028-inch with a tolerance of +.0007- to .0003-inch. Both glass- and paper-base materials conformed to this requirement.

Water Absorption

Federal specification L-P-406, method 7031, was used to prepare and test specimens for water absorption. Water absorption of the paper-base laminates is within the 0.50 percent maximum requirement (table 1).

Specific Gravity

Specific gravity specimen preparation and test methods were in accordance with ASTM specification D-792. There is no stated requirement for the specific gravity of the laminates without copper. A comparison is shown in table 1. The paper-base laminates are 20 to 30 percent lighter in weight than the average weight of glass-base laminates.

Operating Temperature

For maximum operating temperature tests, the circuit in figure 2 was etched on the paper-base laminates being evaluated. Four-inch square specimens were conditioned by allowing to stand at room temperature for several days. The specimens were then subjected to thermal shock, which consisted of exposure to 105°C for one-half hour, followed by a ten-minute exposure in a cold chamber held at —55°C. This constituted one cycle, which was repeated 10 times. Upon completion of this test, visual inspection was made to determine any damage, and resistance tests were conducted with a Simpson meter to determine if minute cracking of the copper foil had occurred. The specimens were then placed in a circulating air oven at 110°C and left to soak at this temperature for one hour. At the end of one hour, the temperature was raised in steps of 10°C, until 170°C was reached. The test specimens were again visually observed and resistance tests conducted after each step. Any delamination, blistering, or electrical failure of the copper foil pattern would be considered a failure. The macroexamination and resistance tests showed that no failures had occurred, nor was there any evidence of blistering, copper foil delamination, or copper foil cracking. See table 1.

Flammability

Flammability specimens were prepared and tests conducted in accordance with ASTM specification D-635. Two specimens (A and B, table 1) were self-extinguishing. The other paper-base materials and the glass-base materials used in the test were not flame-retardant. However, the manufacturer indicates that these laminates can be supplied in flame-retardant form (table 1).

Warp and Twist

Since full size sheets shipped singly arrived in a damaged condition and were not satisfactory for the standard warp and twist test methods specified by MIL-P-21466, the following procedure was used. Specimens 6 by 6

Table 2 — Electrical Tests

Electrical Tests	Paper-Base Sample A	Paper-Base Sample B	Paper-Base Sample C	Paper-Base Sample D	Glass-Base G-10	MIL-P-21466 Requirements
Dielectric Strength, Perpendicular to Laminates, Step by Step, in air, kilovolts	24.75	26.50	24.00	24.50	21.50	
Dielectric Constant, at 1 megacycle	3.958	4.122	4.313	4.127		5.8 maximum
Dissipation Factor, at 1 megacycle	0.0311	0.0325	0.0335	0.0357		0.045 Max.
Surface Resistance, megohms C(96 hr/35°C/90%RH)	572	357	586	328		1000 Min.
Volume Resistivity, megohms-centimeters C(96 hr/35°C/90%RH)	1.80×10^8	∞	$.99 \times 10^8$	1.48×10^8		14×10^6 Min.
High Altitude Flashover, volts a-c						
Sea Level 1/64″ spacing	1200	1383	1383	1200	1450	
1/32″ spacing	1700	1733	1800	1633	1760	
3/64″ spacing	2083	1917	2000	1966	2000	
1/16″ spacing	2366	2120	2060	2150	2200	
Point Configuration	2266	2100	2200	2100	2380	
Round Configuration	2800	3533	3033	2616	2883	
Flat Configuration	2133	2150	2216	2050	2180	
50,000 Feet						
1/64″ spacing	498	520	510	497	650	
1/32″ spacing	613	670	635	647	900	
3/64″ spacing	697	744	747	760	900	
1/16″ spacing	747	908	787	752	1000	
Point Configuration	673	752	773	717	1050	
Round Configuration	980	980	890	1050	1133	
Flat Configuration	800	852	810	803	1100	
70,000 Feet						
1/64″ spacing	413	428	410	420	633	
1/32″ spacing	500	472	490	557	750	
3/64″ spacing	580	557	560	595	817	
1/16″ spacing	648	580	584	667	733	
Point Configuration	590	636	580	673	900	
Round Configuration	752	883	773	847	867	
Flat Configuration	640	680	633	677	760	

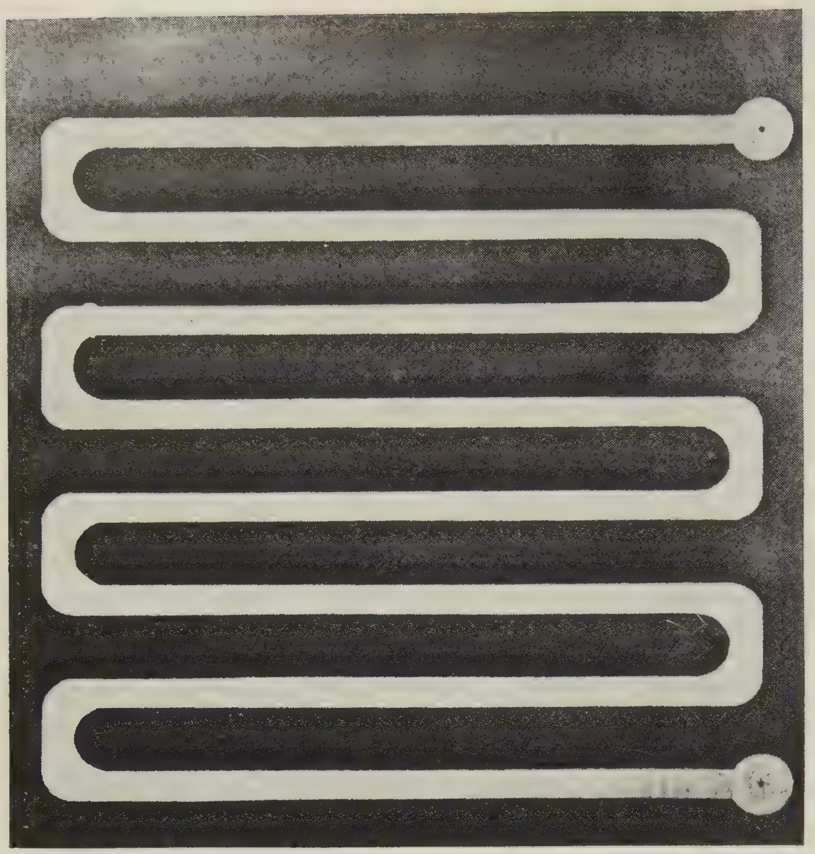


Figure 2, configuration for maximum operating temperature test.

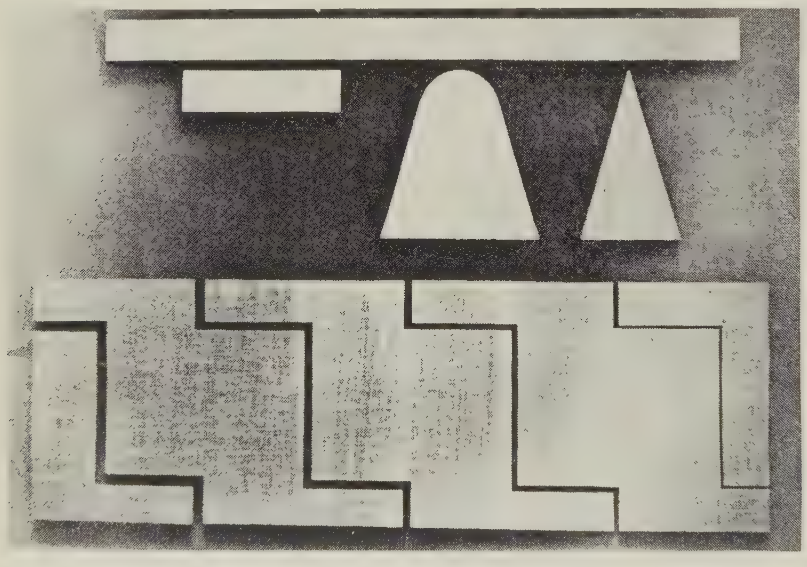


Figure 3, configuration for flashover voltage tests.

inches were prepared, and the height of each corner above a flat surface was measured. The specimens were then subjected to the following temperatures for a soaking period of two hours at each temperature: —55°C, —40°C, room temperature, +71°C, +85°C, and +105°C. Upon completion of a temperature cycling, the specimens were stored for 16 hours at +40°C. The height of each corner was again measured above a flat surface, and the changes noted. Warp and twist results were less than the one percent maximum allowed (table 1).

Dielectric Strength

Dielectric strength tests were conducted in accordance with ASTM specification D-149 and ASTM specification D-229. The dielectric strength tests used the step-by-step method to illustrate the importance of the time factor. The specimens were tested in air with the electrodes perpendicular to the faces of the laminates. Tests showed that the paper-base laminates have an average breakdown voltage of 26.0 kilovolts which is higher than the 21.5 kilovolts breakdown voltage of the glass-base epoxy laminates tested (table 2).

Dielectric Constant And Dissipation Factor

The dielectric constant and dissipation factor tests were conducted in accordance with MIL-P-21466. The dielectric constant and dissipation factor values were well within the specification requirements (table 2).

Resistance

Surface resistance tests were conducted as specified by MIL-P-21466. Specimens were conditioned for 96 hours at 35°C and 90% relative humidity. Sample B (table 2) exceeded the minimum requirements of MIL-P-21466, while the other paper-base laminates did not meet the minimum requirement of 1000 megohms.

For volume resistivity, the same specimens subjected to the surface resistance tests were tested for volume resistivity in accordance with MIL-P-21466. The volume resistivity values of the paper-base laminates exceed the minimum requirements of the specification.

High Altitude Flashover

High altitude flashover test boards, illustrated in figure 3, were etched in test patterns which provided various configurations and spacings. These patterns were used to determine the flashover voltage versus pattern spacing and configuration for altitudes of sea level, 50,000 feet, and 70,000 feet. Figure 4 illustrates the test set-up and equipment used. The pressures required were obtained from an altitude and pressure chart. When the desired altitude was achieved and the required uniform pressure obtained, an a-c potential was gradually applied between the appropriate spacings on the individual test boards. Table 2 lists the values obtained as a result of the flashover voltage tests at the various altitudes. The average flashover voltage of the paper-base laminates was slightly lower than that of the glass-base laminates at 70,000 feet and 1/64-inch spacing, being less than 500 volts. A spacing of 3/64-inch at 70,000 feet shows a minimum flashover voltage of 500. Figures 5 through 8 show typical curves for altitude versus potential for various spacings on the paper-base and glass-base laminates. Figure 9 shows typical curves of how flashover voltage varies with altitude and configuration.

Solder Dip

Solder dip specimens were prepared and tested in accordance with MIL-P-21466. MIL-P-21466 states that no blistering or delamination may be present after 13 seconds exposure to the solder at 500°F. Therefore, blistering or delamination in less than 13 seconds in these tests constituted failure. Difficulty was encountered in meeting the 13-second requirement for solder dip at 500°F. Sample D (table 3) was the only paper-base laminate which passed the 13 second requirement. After 30 seconds, Sample D laminate did not show evidence of blistering or delamination. Sample B withstood 10 seconds before showing failure. Table 3 lists the results of this test.

Solder and Flux Effects

The effect of solder and flux on surface resistance was evaluated by etching one-half of the copper from both sides of 2 by 4-inch pieces of the laminates. The unclad portions of the specimens were checked for resistance using a Simpson meter. Upon completion of the resistance checks, the specimens were coated with flux, solder dipped at 460°F for 4 to 5 seconds, then cleaned with acetone. Resistance readings were taken upon completion of the etching process, and readings were taken again after completion of the cleaning process. No change was noted in either type of material. These data appear in table 3.

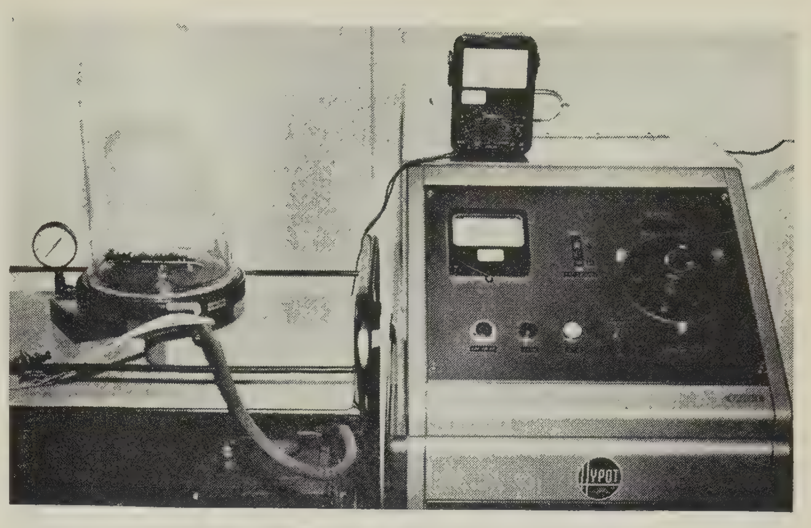


Figure 4, set-up for flashover voltage tests.

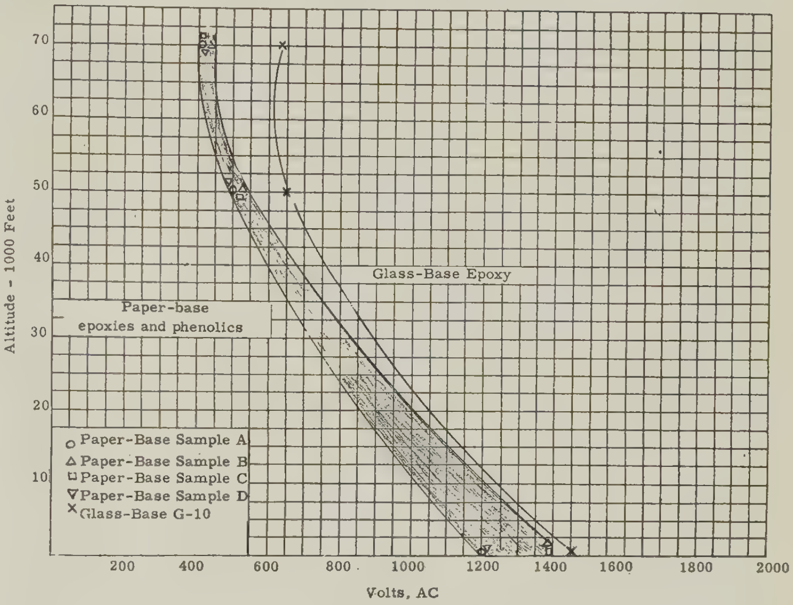


Figure 5, high altitude flashover, 1/64" spacing.

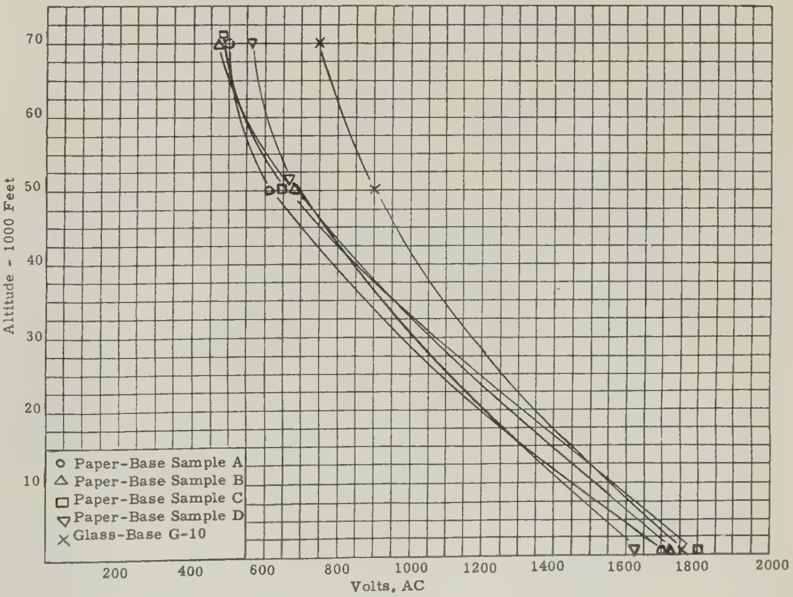


Figure 6, high altitude flashover, 1/32" spacing.

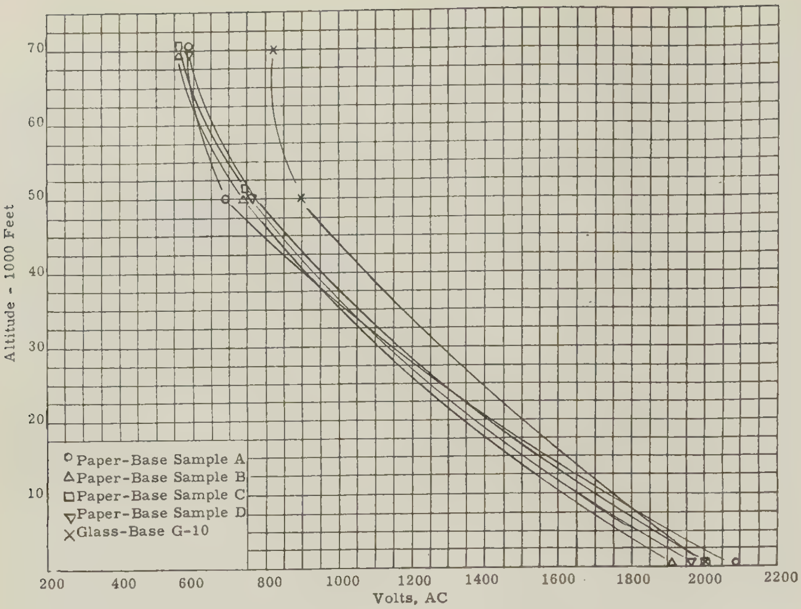


Figure 7, high altitude flashover, 3/64″ spacing

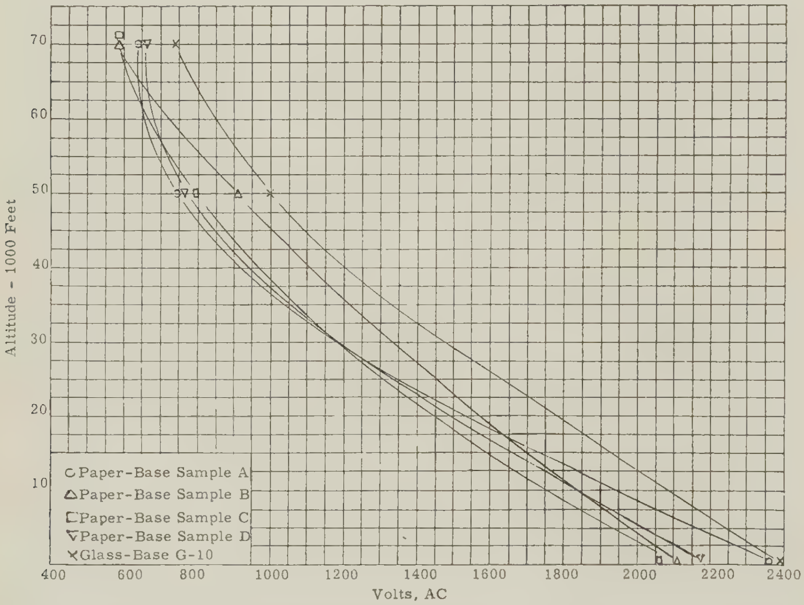


Figure 8, high altitude flashover, 1/16″ spacing.

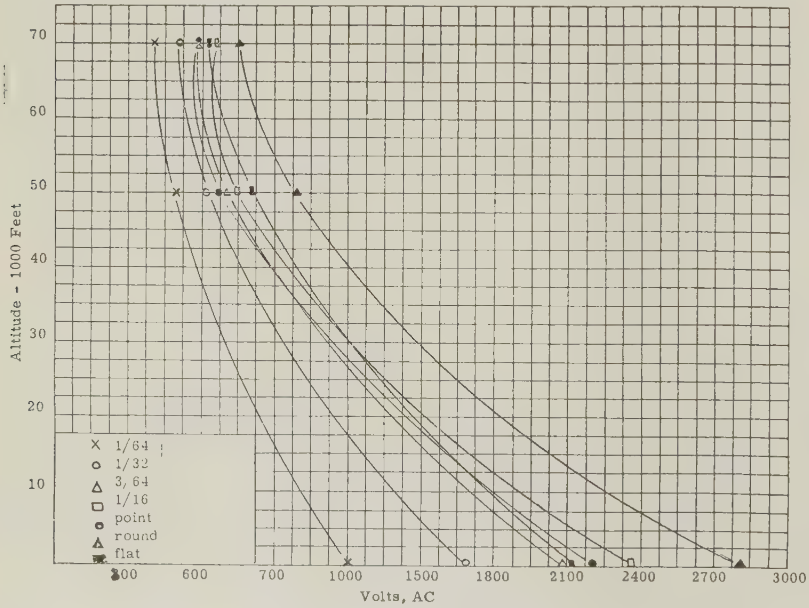


Figure 9, typical curves showing flashover voltage variations.

Machinability

To determine machinability characteristics, the laminates, some with copper foil and others without, were presented to an unbiased production operator to be drilled, punched, sawed, and sheared. The drilling test consisted of drilling 25 holes of the following sizes in each specimen; .0156″, .0312″, .067″, and .125″. Drill speed and rate of feed were observed along with any defects in the holes occurring as a result of drilling. Particular attention was given to cracking, chipping, haloing, and drill wear. The sawing process consisted of band sawing specimens with and without copper foil. The saw cuts were made at right angles to the previous cuts. The edges were visually examined for defects. Punching tests were conducted using a ⅛-inch metal punch and examining the specimens for cracking, haloing, and other defects on both clad and non-clad laminates. The evaluation of the punching tests were graded as shown in ASTM specifications D-617. The test die specified by ASTM D-617 which produces a configuration as shown in figure 10 was not available. However, an attempt was made to utilize metal-punching dies in our shop area. Cracking and other defects were noted when these dies were used. In the comparison, however, the paper-base epoxy laminates, both bare and foil-clad, illustrate that punching is highly feasible, and little difficulty will be encountered provided the proper punches are used. The present grade G-10 and G-11 glass-epoxy laminates are not capable of being punched satisfactorily. Both types of material can be drilled, sawed, or sheared.

Copper clad material can be drilled satisfactorily. Without copper, drilling caused chipping of the sample C material. Tool wear is slight for the paper-base laminates as compared to the severe tool wear encountered in the drilling of the glass-base laminates. Tool wear when sawing or shearing the glass-base laminates is high. Table 3 lists data on punching, drilling, sawing, and shearing.

In addition, extensive preliminary investigation at Martin-Orlando has

Table 3 — Application Tests

Application Tests	Paper-Base Sample A	Paper-Base Sample B	Paper-Base Sample C	Paper-Base Sample D	Glass-Base G-10	MIL-P-21466 Requirements
Solder Dip, Seconds, 500°F	7	10	3	30		13 Minimum
Solder and Flux Effects	None	None	None	None	None	
Shearing, With Copper-Foil	Good	Good	Good	Good	Good	
Without Copper-Foil	Good	Fair	Fair	Fair	Good	
Punching, With Copper-Foil	25	25	25	25	Poor	
Without Copper-Foil	0-25	0-25	0-25	0-25	Poor	
Sawing, With Copper-Foil	Good	Good	Good	Good	Fair	
Without Copper-Foil	Good	Good	Good	Good	Fair	
Drilling, With Copper-Foil .0156″	Good	Good	Good	Good	Good	
.0312″	Good	Good	Good	Good	Good	
.0625″	Good	Good	Good	Good	Good	
.0635″	Good	Good	Good	Good	Good	
.0670″	Good	Good	Good	Good	Good	
.1250″	Good	Good	Good	Good	Good	
Drilling, Without Copper-Foil .0156″	Fair*	Fair*	Poor	Fair*	Good	
.0312″	Good	Fair*	Poor	Fair*	Good	
.0625″	Fair*	Fair	Poor	Fair*	Good	
.0635″	Fair*	Fair	Poor	Fair*	Good	
.0670″	Good	Fair*	Poor	Fair*	Good	
.1256″	Good	Good	Poor	Poor	Good	
Etching	Good	Good	Good	Good	Good	

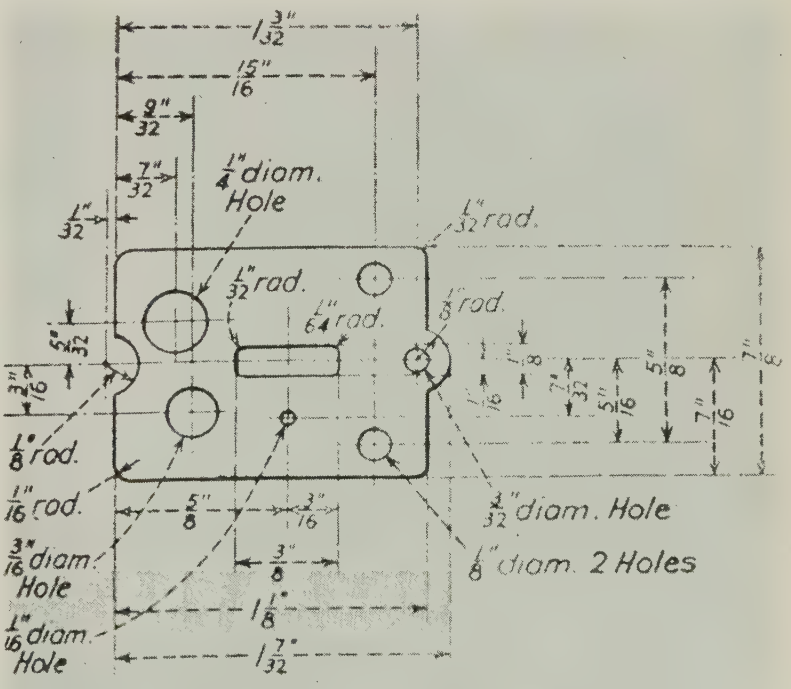
**Material cracks or splits when drilled at high speed. At low speeds material drills satisfactorily.*

indicated that through-hole plating in holes drilled or punched in paper-base material is definitely superior to through-hole plating in glass-base material.

Summary

In addition to lower cost, paper-base laminates have the following advantages over glass-base laminates:

1. Paper-base material weighs 20 to 30 percent less than comparable glass-base material.
2. Paper-base material is more susceptible to machining operations than glass-base materials. This is reflected in reduced tool wear during production operations, and also in a lower percentage of rejects resulting from machining operations.
3. Paper-base material can be satisfactorily hole punched with production equipment. Glass-base material cannot be punched satisfactorily.



For Materials 1/64" to 1/8" in Thickness, Inclusive. Variations of ±0.005" Permitted, Unless Otherwise Specified.

Figure 10, ASTM standard punched test specimen.

Continuous-Production Vacuum Furnace For Ceramic Wafer Electron Tubes

A continuous-production vacuum furnace for evacuating and sealing ceramic wafer electron tubes has been designed by the National Bureau of Standards for the Navy Bureau of Aeronautics—mechanical development and construction were undertaken on contract by Sanders Associates Inc., Nashua, N.H.

With this system, the tube assembly is introduced into a vacuum and heated to a high temperature. The combination of heat and vacuum degasses the tube, and the high temperature brazes together the metallized surfaces of the ceramic wafers to make a hermetically sealed unit.

The machine was conceived and designed by C. P. Marsden of the Bureau's electron devices laboratory. The automatic production methods for ceramic wafer tubes required processing the assemblies into completely sealed and ready-to-use units by evacuating, degassing, and sealing in a single continuous operation. The vacuum furnace performs these operations with control of only temperature, degree of vacuum, and time of processing. The high temperature eliminates the need for getters, thus simplifying tube design. The furnace has been used to produce up to 200 tube assemblies an hour.

Essentially, the vacuum furnace is a vertical tube, about 11 feet long, of heat-resisting alloy, surrounded by a heating unit, and open to the atmosphere at both ends. Through this tube passes a series of hollow cylindrical specimen carriers, each separated by a short piston fitting closely inside the tube. These parts are introduced into the top of the tube at atmospheric pressure; once inside, they are evacuated through ports along the side of the tube and through holes in the carriers. The pistons and carriers pass through the tube under gravity feed. In the prototype model, the sliding fit of the pistons maintains the vacuum at 10^{-5}mm Hg, and the central portion of the tube can be heated to 1000°C. After processing, the parts are removed from the lower end of the tube at atmospheric pressure

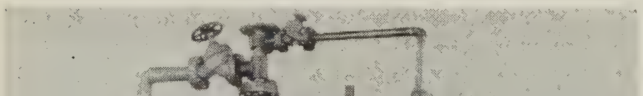


Figure 1, overall view of continuous-production vacuum furnace designed by NBS. Vertical tube in center is the furnace itself; items to be heated are inserted in top of furnace and withdrawn at the bottom. Surrounding the furnace is the control and vacuum equipment. Photo courtesy Sanders Associates Inc.

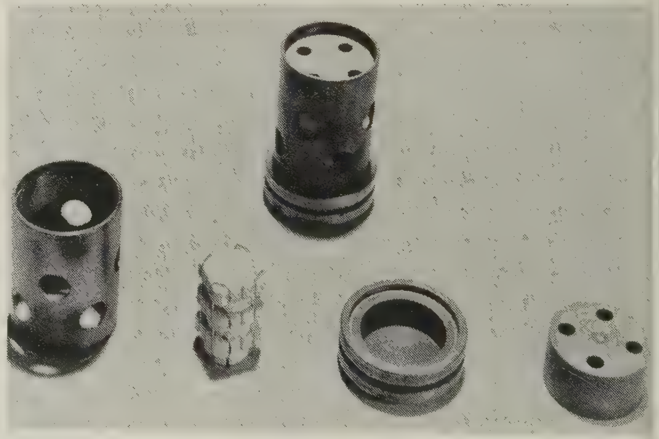


Figure 2, specimen carriers with sample ceramic assembly to be evacuated and sealed. Holes in carriers permit air to be withdrawn inside of furnace. Photo courtesy Sanders Associates Inc.

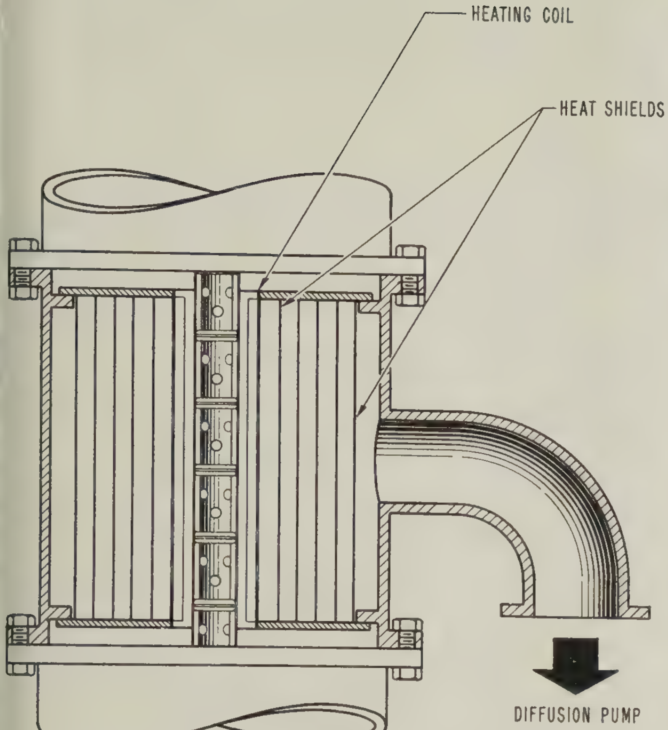


Figure 3, cross-sectional drawing of furnace, showing several carriers passing through evacuated central tube. Central tube is surrounded by heating coil and a number of heat shields.

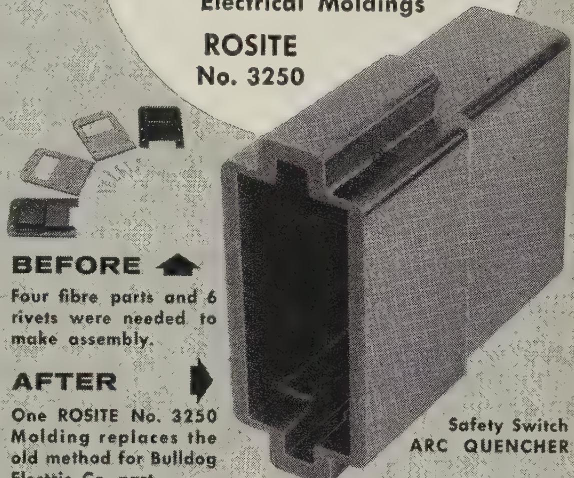
and at reduced temperature.

The central 7-foot portion of the tube is surrounded by the electric heating element. This element is simply resistance wire supported in the inner side of a grooved ceramic cylinder. Five heat reflecting shields surround the heating unit; the inner two are of molybdenum, the outer three of stainless steel.

The carriers, 2 inches in diameter and about 4 inches long, are of alloy steel and fit closely inside the tube. They contain a number of ½-inch holes to permit escape of gas. The outside bearing surfaces of the pistons are flame-coated with tungsten carbide to prevent the bare metal surfaces from brazing together in the intense heat of the furnace section. This coating is extremely hard; after the machine had been used continuously for 6 months, the coated surfaces showed negligible signs of wear.

Several vacuum pumps are employed to reduce the air pressure near the ends of the tube and to maintain a high degree of vacuum in the central heating section. Relatively little air leaks into the system past the carriers and pistons; the air removed from the central section is mostly that desorbed from the surfaces of the parts entering the system.

Reportedly, a similar machine could well be devised for continuously processing devices other than ceramic radio tubes. The coating of lenses or resistors by vapor-plating, and the production of vacuum condensers and switches are possible applications. Where the processed article must come out of the vacuum near room temperature, the lower end of the furnace could be lengthened and water-cooled.



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European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Illinois.

Insulation Materials In the High Voltage Technique

By Karl Pothoff, Elektrotechnische Zeitschrift Pt. B, Vol. 12, No. 7, 4 April 1960, pp. 121-127. Original title: "Isolierstoffe in der Hochspannungstechnik." Professor Dr. ing. K. Pothoff heads the laboratory of the AEG-transformer factory and is lecturer for the science of materials of electrical engineering at the Technical high school, Stuttgart (W. Germany).

In this article, the author gives guiding principles for the selection of materials for high voltage insulation systems with the help of examples of construction elements instead of, as is usual, selection on a chemical basis.

The usual constructions are mostly systems with two or three materials, i. e., combinations of insulation materials whereby, as far as possible, good homogeneity is achieved by means of very fine subdivisions.

The insulation of high voltage cables consists of paper and insulating oil. The density of this pure natron-cellulose paper varies between 0.6 and perhaps 1.35. The author is inclined to the viewpoint that the density of the most compact cellulose is 1.45 rather than 1.56. The difference between say 0.6 and 1.45 is a measure of the impregnability of the paper. The dielectric constant also varies with the density of the paper (dielectric constant of pure cellulose is 5.6, of oil 2.3).

The conductivity of the water extract of the paper is very important as a measure of the purity of the paper. VDE (W. Germany) standardizes paper according to these two standpoints.

The high voltage condenser bushing (phenol-paper-air) is a classical system with three insulation materials. Instead of a crack-sensitive, high-resin content wrapping insulation of high capacitance, one with a small specific weight (with air spaces) is used. Corona is avoided by finely subdividing the air gaps with very thin paper.

An interesting problem is also the insulation of the stator windings of high voltage rotating machines.

The author also touches on the special problems of transformers. The big problem here is oil quality. Tan δ-measurements and breakdown voltage with the VDE spark-gap give better information about the oil than conductivity and the American spark-gap. One would think that everything is known after so many years of always constructing transformers with practically the same materials. But thanks to the ever-increasing power per unit weight of transformers, the conservation of oil, especially, is a very real problem.

Dielectric Losses in a Laminated Insulation Caused by Ion Movements

By Wolfgang Held and Kurt Wenzel, Elektrotechnische Zeitschrift Pt. A., Vol. 81, No. 4, 15 February 1960, pp. 121-127. Original title: "Dielektrische Verluste durch Ionenleitung im geschichteten Dielektrikum." W. Held and K. Wenzel are with Siemens-Schickert-Werke in Berlin (Germany).

An impregnated laminated dielectric (condensers, cables, etc.) consists of layers of solid insulation with thin insulating liquid in between them having a thickness of 2-5 μm. When a sinusoidal voltage is applied, ions start moving in the liquid. With small field strengths, the paths of the ions are so small that they can move unhindered to and fro without striking the solid insulation wall. As the field strength increases, the paths of the ions become bigger until at last the ions strike the walls of the solid insulation before the lapse of half a period. The ionic current returns to zero until the reversal of the voltage. That is, with increasing field strength or temperature, the time periods during which the ions move become shorter and shorter because of the limited paths of the ions. Short ionic current peaks result after every passage of the voltage through zero. The larger the field strength is, the shorter is the time during which an ionic current flows. Correspondingly, the ions contribute less and less to the dielectric losses, so that the dielectric loss factor decreases with increasing field strength.

In the article, a theoretical function is derived which gives the course of the curve of the loss factor (tanδ) caused by movements of the ions as a function of the number and size of the ions in the impregnating medium, viscosity, geometrical shape of the dielectric, dielectric constant field strength and frequency. The tests which were performed with a paper-clophen dielectric, show that the derived formulas give values which correspond well to the measurements. With these formulas, a better understanding and interpretation of the test results is possible as well as a better insight into the mechanisms and the consequences of the aging process of condenser dielectrics.

Micadur, a New Insulation for Stator Windings of Electrical Machines

By B. Doljak, M. Moravec, and O. Wohlfahrt, Brown, Boveri Review, Vol. 47, No. 5/6, pp. 352-360.

After Brown Boveri had used a mica folium insulation system with great success for over 30 years, a fundamentally new system was developed and introduced—its development involved new requirements of a constructional nature and certain manufacturing considerations.

By means of exhaustive investigations, the most suitable materials were selected from the large number available. The report contains important examples of measurements and test equipment. For the individual maerials, in particular the resins used for impregnating, the changes in physical properties during thermal aging were plotted (volume, weight, mechanical strength, etc.).

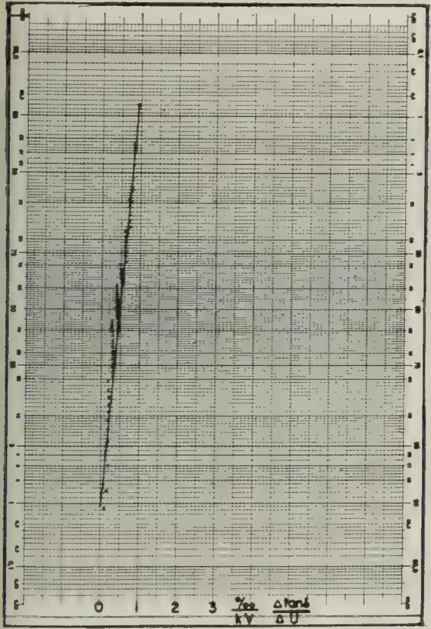
The experiments on test bars should provide information as to the mechanical, dielectric, and thermal aspects regarding the behavior which may be anticipated in service.

To check the changes in the insulating system during aging, the power factor (tan δ) was measured at intervals as a function of the voltage. In conformity with standard European practice, the maximum rate of increase of power factor is expressed in 0.1% (denoted by %o) per kv as a measure of the change in insulation between two measurements, i. e.,

$$\frac{\Delta \tan \delta}{\Delta U}\left[\frac{\%o}{kv}\right]$$

The Micadur system is an insulation consisting of mica and glass fabric tape—i. e., continuous-impregnated in vacuum with a polymerizable synthetic resin containing no solvent. This resin possesses the most favorable mechanical properties of epoxy resins and the dielectric values of polyester resins.

As proof of the degree of uniformity attained in production, the accompanying curve was reproduced, showing the results of acceptance tests on the bars of a hydroelectric generator.



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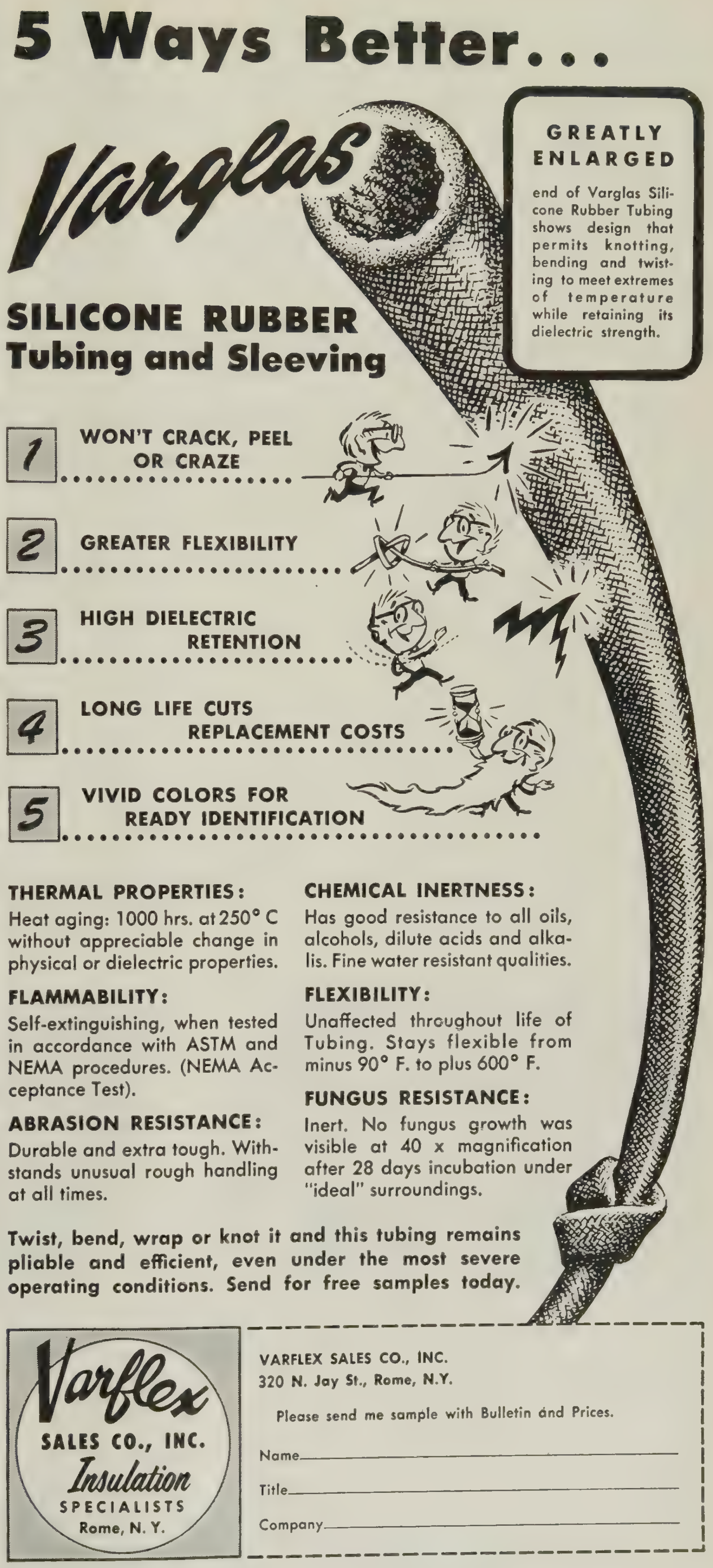
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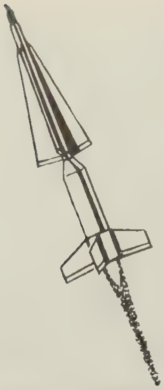

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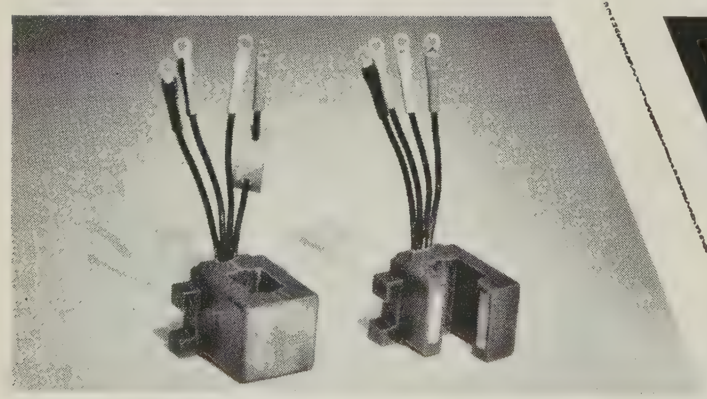
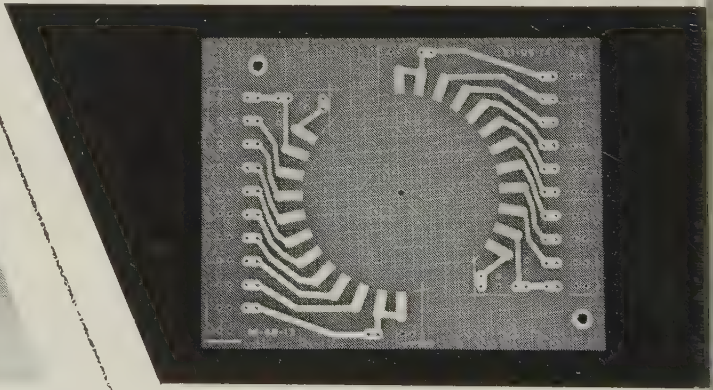
The extra strength and outstanding electrical properties of epoxy-glass fiber laminates make them ideal in the production of high-quality printed circuit assemblies, for civilian as well as military applications. For more information on Bakelite epoxy resins, write Dept. CU-75, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.



Bakelite epoxy compounds are also widely used for encapsulating electrical components. The low viscosity of the uncured resin assures complete penetration into the tiniest crevices, providing optimum electrical insulation. The encapsulated coils are made by Deluxe Coils, Inc., Wabash, Indiana.



Typical printed circuit board, shown here, is made of glass fiber laminated with Bakelite epoxy resin. The copper clad laminate is made by Synthane Corporation, Oaks, Pa., for a military application.

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Print Ins. 24 on Reader Service Card

A New Grade of Low Temperature Vinyl Electrical Insulating Tubing

By L. E. Seiffert, Supervisor Materials Engineer, Bureau of Ships, Navy Department, Washington 25, D.C.; and H. K. Graves, Supervisor Electrical Engineer, Material Laboratory, New York Naval Shipyard, Brooklyn 1, N.Y.

Note: The opinions or assertions contained in this paper are the private ones of the authors and are not to be construed as official or reflecting the views of the Naval Service at large.

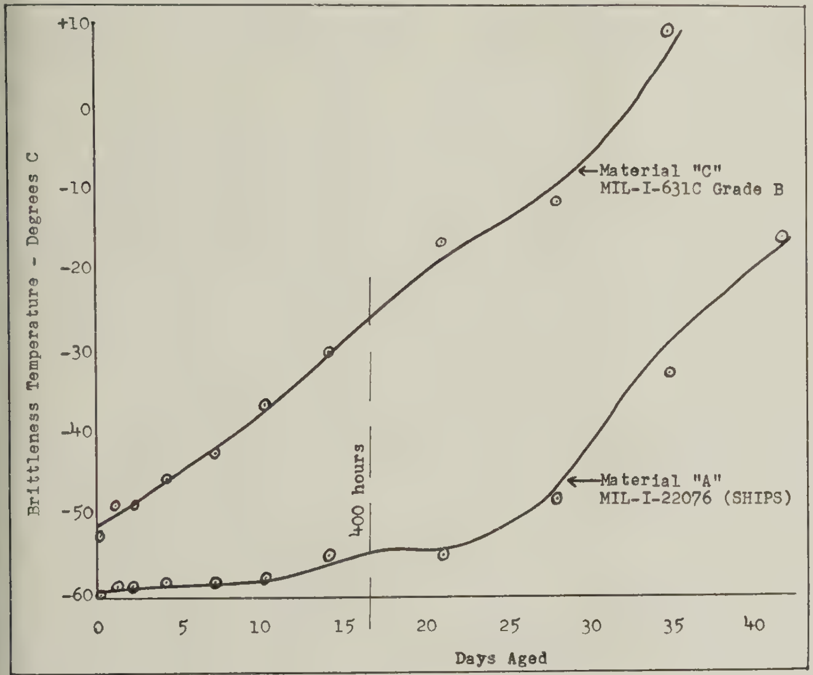

Figure 1, effect of 100°C aging on brittleness temperature of #18 AWG tubing.

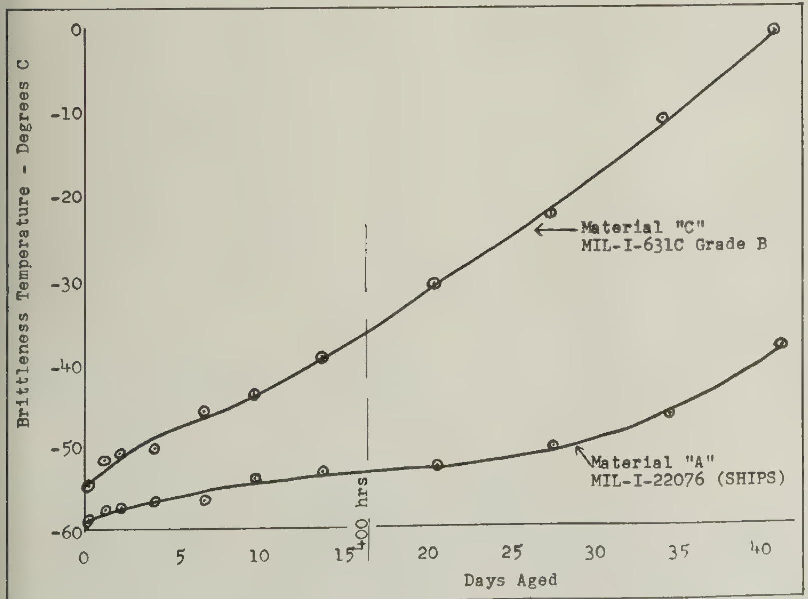

Figure 2, effect of 100°C aging on brittleness temperature of #12 AWG tubing.

The Bureau of Ships recently issued Specification MIL-I-22076(SHIPS) as amended 15 December 1959 covering a very low temperature grade of non-rigid vinyl electrical insulating tubing. This type of tubing is intended for use in applications where some degree of flexing of leads is expected under conditions of very low ambient temperature and where good electrical protection is also required. Since operating temperatures may be high in these same applications, the compounds must show good thermal stability so that they retain their low temperature flexibility after operating at high temperatures.

It has been noted in the past that many of the so-called low temperature vinyl tubings rapidly lost plasticizer and flexibility at elevated temperatures. It could be shown that after limited service at class A temperatures, many of these compounds were less flexible and more likely to break when flexed than some of the general purpose grades after the same exposure. "As received" low temperature flexibility would therefore have little meaning.

It is precisely in this area (retention of low temperature characteristics after aging at high temperature) that materials conforming to Specification MIL-I-22076(SHIPS) are superior to vinyl tubings covered by other specifications.

This article presents representative data obtained by the Material Laboratory, New York Naval Shipyard, on tubings conforming to Specification MIL-I-22076(SHIPS) and compares these data with similar information obtained on a representative tubing conforming to Type F, Grade b of

Table 1—Comparison of Mechanical and Thermal Properties of Vinyl (Materials A, B, and C; Sizes 18 and 12)

		MIL-I-22076 (SHIPS)						MIL-I-631C, Type F, Grade b			
		Values Obtained				Requirements		Values Obtained		Requirements	
		A		B				C			
Property	Conditioning	18	12	18	12	18	12	18	12	18	12
Wall Thick., Inch		0.0149	0.0176	0.0141	0.0149	0.013-0.019	0.013-0.019	0.0149	0.0157	0.013-0.019	0.013-0.019
Brittleness Temp., °C	As received	−59.8	−59.2	−62.0	−65.6	−55(max)	−55(max)	−52.8	−55.0	−46(max)	−46(max)
Brittleness Temp., °C	E-400/100	−56.0	−54.5	−53.5	−57.5			−26.0	−37.5		
Brittleness Temp. change on aging, °C	E-400/100	3.8	4.7	8.5	8.1	15(max)	15(max)	26.8	17.5		
Tensile Strength, psi	C-96/23/50	2065	1895	2025	2205	1800(min)	1800(min)	2690	2710	1450(min)	1450(min)
Elongation, %	C-96/23/50	390	438	392	380	250-450	250-450	335	361	200-150	200-450
Elongation Change, %	E-400/100	1.0	3.4	12.5	5.5	—	—	22.1	20.8	35(max)	35(max)
Softening Temp. (Penetration), °C	C-96/23/50	95.6	95.2	95.3	93.5	80(min)	80(min)	98.6	98.0	70(min)	70(min)
Lengthwise Shrinkage, %	E-2/100	3.8	4.0	6.3	7.5	10(max)	10(max)	2.1	2.3	10(max)	10(max)

C-96/23/50—96 hours at 23°C and 50% relative humidity.
E-400/100—400 hours at 100°C.
E-2/100—2 hours at 100°C.

Table 2 — Comparison of Electrical, Flame Resistance, and Miscellaneous Properties of Vinyl Tubing (Materials A, B, and C; Sizes 18 and 6)

		MIL-I-22076 (SHIPS)						MIL-I-631C, Type F, Grade b			
		Values Obtained				Requirements		Values Obtained		Requirements	
		A		B				C			
Property	Conditioning	18	6	18	6	18	6	18	6	18	6
Diel. Strength, volts/mil	C-96/23/0	930	657	900	716	650(min)	550(min)	1115	867	750(min)	650(min)
Retention of Dry Diel. Strength, %	C-96/23/96	87.8	78.5	78.0	85.3	70(min)	70(min)	100	103.8	85(min)	85(min)
Dissipation Factor, 1 kc	C-96/23/0		0.099		0.118		0.14(max)		0.071		0.14(max)
	C-96/23/96		0.141		0.131		0.16(max)		0.079		0.16(max)
Diel. Constant, 1 kc	C-96/23/0		6.33		6.75		8.0(max)		6.19		7.0(max)
	C-96/23/96		8.71		6.79		10.0(max)		6.66		8.0(max)
Volume Resist., ohm cms	D_t-21/23	21×10^9	17×10^9	19×10^9	20×10^9	10^9	10^9	9.7×10^{10}	6.9×10^{10}		10^{10}(min)
Flame resist. Burning Time, seconds		0	9.8	0	14.0	15(max)	15(max)	0	5	15(max)	15(max)
Flame Travel, inches		2.2	2.9	2.1	2.7	10(max)	10(max)	2.1	2.7	10(max)	10(max)
Oil resistance	E-200/50	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Corrosive Effect on Copper, % increase in resist.			0.8		0.2		2(max)		0.6		2(max)
Fungus Resist., rating		0	0	0	0	1(max)	1(max)	0	0	1(max)	1(max)

C-96/23/0—96 hours at 23°C and 0% relative humidity.
C-96/23/96—96 hours at 23°C and 96% relative humidity.
D_t-24/23—24 hours at 23°C in 1% salt water.
E-200/50—200 hours at 50°C.

pecification MIL-I-631C.

The purpose of this comparison is o illustrate the superiority of Speci-cation MIL-I-22076(SHIPS) tubing n low temperature characteristics and etention of these characteristics after ging at 100°C. It also shows that this dvantage is obtained with only minor acrifices in other properties.

In figures 1 and 2, representative inyl tubings in two sizes conforming o Specification MIL-I-22076(SHIPS) nd conforming to Grade b of Specifi-ation MIL-I-631C, are compared rel-tive to the effect of aging at 100°C n their low temperature brittleness s measured by the motor driven ap-aratus specified in ASTM D746. It vill be noted that material A has a ower brittleness temperature initially han material C and that the brit-leness temperature of material A hanges less than 6°C after 21 days ging at 100°C. On the other hand, the brittleness temperature of material C (conforming to Grade b of Specification MIL-I-631C) changes as much at 35.8°C after 21 days aging at 100°C. This is a remarkable improvement in retention of flexibility characteristics after aging at 100°C in material C as compared with material A.

To control this characteristic in Specification MIL-I-22076(SHIPS), two requirements are specified:

Brittleness temperature (as received) = — 55°C (max.)

Brittleness temperature change = 15°C (max.) on aging E-400/100

It might be noted at this point that the brittleness temperature of a tubing does not mean that the tubing will not operate satisfactorily below this temperature. It is the point where 50% of the specimens tested will exhibit a brittle failure under specified conditions of rapid deformation. In many applications, conditions of deformation will be less severe, and in such cases, the method will not predict a low temperature limit of use. The brittle temperature will, however, compare materials directly, indicating which are better for low temperature applications as well as giving a measure of how much better. As has been demonstrated in the work involved in setting up this new specification, it can also be used to indicate relative compound stability.

As will be seen by a study of table 1, the improvement in low temperature characteristics is achieved without reducing mechanical or thermal properties below those required for MIL-I-631C Grade b tubing. Tensile and elongation properties are satisfactory. Softening temperature is high and lengthwise shrinkage limits require no change.

Table 2 indicates some sacrifice in electrical properties in the case of Specification MIL-I-22076(SHIPS). This occurs principally in the retention of dielectric strength after high humidity conditioning. However, the specified electrical properties are still maintained at a relatively high level suitable for aircraft applications, and dielectric strength is at a much higher level than the 200 volts per mil specified in Specification MIL-I-7444B.

Table 2 shows that no change was required in the specification limits for such characteristics as flame resistance, oil resistance, corrosive effect on copper, and fungus resistance in order to obtain the superior low temperature characteristics.

In conclusion, vinyl tubings conforming to Specification MIL-I-22076-(SHIPS) are now available, with retention of low temperature characteristics after aging at high temperature (100°C) superior to tubings covered by Grade b of MIL-I-631C. This improvement in low temperature characteristics is obtained with no sacrifice in mechanical properties and relatively little sacrifice in electrical properties. In addition, electrical properties are held at a better quality level than for other aeronautical grades. Such vinyl tubings should, therefore, obtain much greater usage in aircraft applications. It is hoped that the information in this article will encourage more manufacturers to produce the generally superior tubing.

Times Haven't Changed

One cave-man to another: "Don't tell me there's no connection. We never used to have weather like this before they used bows and arrows."

—*The Kablegram*

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Pressure-Sensitive Tape — Used as a Class H insulating tape. Available 0.0035", 0.006" and 0.013" thick, in standard widths from ½" to 2" in 18-yard and 36-yard rolls. A special 12" wide tape is now available by the linear yard.

Standard and Cementable Tapes — .002" to .005" thick in widths from ¼" to 24"; .006" to .096" thick in widths from ½" to 24".

TEFLON SHEETS

Standard sizes are.
24"x24" and 48"x48"

THICKNESS (inches)	WEIGHT (lbs./sq. ft.)	THICKNESS (inches)	WEIGHT (lbs./sq. ft.)
1/16	0.75	½	6.00
⅛	1.5	¾	9.00
3/16	2.25	1	12.00
¼	3.00		

RODS

EXTRUDED — ¼" to 2" diameter in increments of 1/16", in lengths up to 12'.

MOLDED — 1⅛" to 2" diameter lengths up to 12", in increments of ⅛"; 2" O.D. and over in increments of ¼" in lengths from 6" to 12".

MOLDED CYLINDERS

2" O.D. and up with minimum wall thickness of ½" in increments of ¼". Maximum length is 12".

*duPont trademark

CHEMICAL & POWER
PRODUCTS, Inc.

11 Broadway, New York 4, N. Y.

Print Ins. 25 on Reader Service Card

Industry News

Allis-Chalmers Mfg. Co., Milwaukee, has acquired 50 percent of the common stock of *Consolidated Systems Corp.*, Monrovia, Cal., formerly a wholly-owned subsidiary of *Bell & Howell's Consolidated Electrodynamics Corp.*

United Industrial Corp., Los Angeles, manufacturer of electronic equipment and other products, is distributing as dividends to common stockholders shares of each of two subsidiaries, *Aircraft Armaments Inc.*, Cockeysville, Md., and *U. S. Semiconductor Products*, Phoenix, Ariz., both manufacturers of electronic equipment, systems, and instrumentation. Additional shares will be made available later, although United will retain working control.

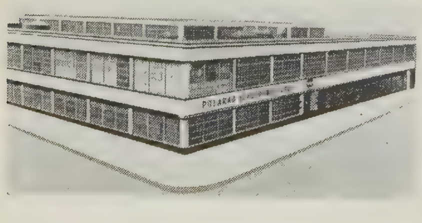
The Epoxylite Corp., formulator of epoxy resin compounds, has moved to new quarters in South El Monte, Cal., with a 100 percent increase in laboratory, production, and office facilities.

McGraw-Edison Co. has acquired the *Alrectic Div.* of *Handley-Brown Co.*, including the Jackson (Mich.) plant and the Alrectic patents. Alrectic manufactures electric distribution and transmission equipment.

Tech-Air Plastics Co., Morristown, N.J., plastics molder, has added new molding machinery and modernized much of its older equipment.

Polymer Corp., Reading, Pa., has begun construction of a new plant in Northwestern Industrial Park, Rolling Meadows, Chicago, to coat metal parts with plastic by a patented fluidized bed coating process. The structure will also be used as a warehouse for plastic stock shapes.

Polarad Electronics Corp. recently acquired 100,000 sq ft of modern manufacturing space adjacent to its existing plant in Long Island City, N.Y. It doubles the facilities formerly available for the manufacture of microwave electronic instruments and military contract work.



For the first six months of 1960, *General Electric Co.* recorded earnings of $111,429,000, off 5% from the same period last year. Net sales were $2,022,699,000, down 2% from 1959. Earnings were $1.26 a share, compared to $1.34 for the same period last year. G-E is constructing a new plant for the manufacture of silicone intermediates at Waterford, N.Y. Costing nearly $3-million and adding more than 15,000 sq ft, it will replace smaller existing facilities which will be converted for other manufacturing needs.

The *Advanced Device Research Laboratory* of the *Semiconductor Div., Sylvania Electric Products Inc.*, a subsidiary of *General Telephone & Electronics Corp.*, has been moved from Northlake, Ill., to Waltham, Mass. It is anticipated that the laboratory will be moved early in 1961 to Woburn, Mass., site of the division's headquarters and general engineering laboratories.

New representatives for the "Teflon" tape, rods, tubes, sheets, and gaskets manufactured by *Chemo Products Inc.*, W. Warwick, R.I., are: *Service Cable and Wire Inc.*, Los Angeles; *Zak-Cowen & Associates Inc.*, Clayton, Mo.; *The Rex May Co.*, Dallas; and *Paisley Products of Canada Ltd.*, Toronto.

Second quarter sales of $134,343,955 and earnings of $16,148,091, or 32 cents per share of common stock, have been reported by *Minnesota Mining and Manufacturing Co.*, St. Paul, Minn. In the same period in 1959, sales were $122,186,325, with earnings of $15,640,554, or 31 cents per share of common stock. For the first six months, sales totaled $263,013,173 compared with $237,358,645 in 1959. Also, 3M recently purchased *Revere Camera Co.*, Chicago.

Hercules Powder Co., Wilmington, has reported second quarter net income of 87 cents a share of common stock. Net income in the second quarter of 1959 was 79 cents a share. Net sales and operating revenues for the first six months were $160,496,882, compared with $137,200,312 in 1959. Net income for the first six months of 1960 was equal to $1.51 a share, compared to $1.36 a share in 1959.

Peschel Electronics Inc., Patterson, N.Y., manufacturer of test equipment for the electrical wire and cable industry, has appointed *Thompson Associates*, Los Angeles, to represent it in California.

McGraw-Edison Co. has renamed its *Coolerator Div.*, Albion, Mich., the *Albion Div.* as a result of diversification into electric heating products.

A $600,000 plant expansion will double the production facilities of the *Massa Div.* (Hingham, Mass.), of *Cohu Electronics Inc.*, electronic instruments and systems manufacturer.

J. M. Loge, Sound Engineers, has incorporated under the new name of *Loge Electronics Inc.* The firm expects to expand its operations in the advanced design and development of intercommunications systems.

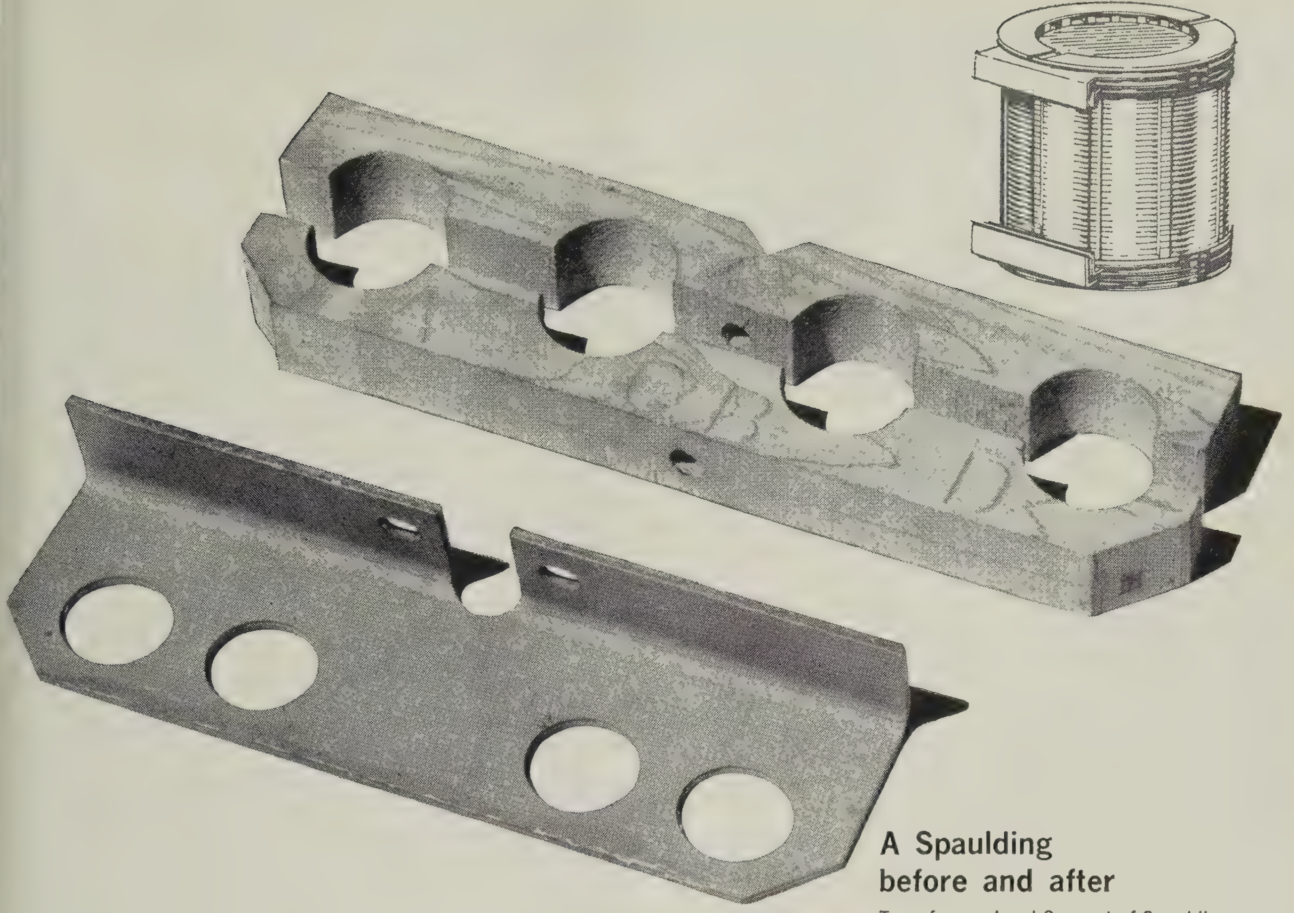
Cornell University, the *University of Pennsylvania*, and *Northwestern University* have been selected to set up enlarged programs for the expansion of basic research in the science of materials under a long-term contract with the *Advanced Research Projects Agency, Dept. of Defense.*

Victory Engineering Corp., Union, N.J., plans to construct a new building for electronics parts manufacture which will have over three times the floor space of the present factory.

George C. Borthig Co. Inc., electrical insulating varnish manfacturer, has relocated its production, laboratory, and office facilities to new and larger quarters on Staten Island, N.Y.

Giannini Scientific Corp., New York City, has acquired *Wiley Electronics Co.*, Phoenix, Ariz. Wiley specializes in the fields of coherent radar and microwave radiometry.

The Sterling Varnish Co., Sewickley, Pa., has appointed *Robert W. Chapman & Co.*, Charlotte, N.C., as



A Spaulding before and after

Transformer Lead Support of Spaulding Vulcanized Fibre replaces wood, eliminating high rejection of parts, reducing number of parts and assembly time, cutting cost by two-thirds.

NOW IT'S CALLED VALUE ANALYSIS

As any Spaulding customer can tell you, the only thing new about Value Analysis is the name.

Spaulding has been rendering this service for years with engineers who evaluate a part or assembly, then show how it can be made better, easier and at a lower cost with a Spaulding Material, processed by Spaulding's own Fabricating Department.

The unique characteristics of Spaulding Industrial Plastics and Vulcanized Fibre hold the same advantages for *your* product.

SPAULDING FIBRE COMPANY, INC.
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SPAULDING VALUE ANALYSIS

Reduced 11 Operations to 2 Operations.

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SPAULDING FIBRE COMPANY, INC.
371 Wheeler Street
Tonawanda, New York

Please send a free copy of the brochure, "Spaulding Value Analysis."

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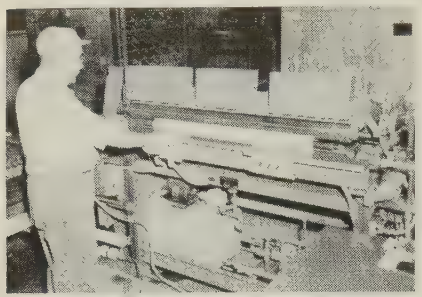
its representative in North and South Carolina.

A specially-designed tube winder has recently been installed by *Synthane Corp.*, Oaks, Pa., to improve



quality control and increase production of laminated plastic tubing.

The name of *Empire State Laboratories Inc.*, Bellmore, L.I., N.Y., subcontractor of electrical and electronic parts and assemblies, has been changed to *Empire Flight Components Inc.* Controlling stock interest has been acquired by Helmuth W. Waldorf, formerly owner of the *Waldorf Instrument Co.* which, in 1956, became a division of *F. C. Huyck Corp.*

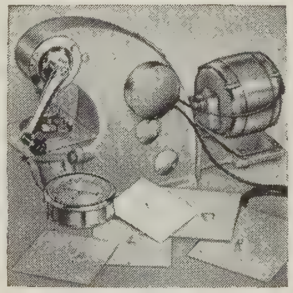
At Lansdale, Pa., *Philco Corp.* has completed its new $3.5-million transis-

tor plant. The Lansdale Division has also begun construction of an extension to its 100,000 sq ft Spring City, Pa., plant.

This Thickness Gauge Measures Strip or Sheet Stock In 10/1000ths of an Inch

Cady
10/1000
Micrometer
Carbide
Tipped
Anvils
Available

Portable and other models also available



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Automatic
Burst
Tester
for
Papers
& Boards

CADYTEST INSTRUMENTS
Register Thickness, Burst Strength and Basis Weight.
Write for Brochure.

E. J. CADY & COMPANY
682 N. Harlem Avenue, River Forest, Illinois

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Custom fabricating of ceramics, glass, and glass-bonded mica materials is now being offered by *Ceramic Fabricators Inc.*, Lyndhurst, N.J.

Construction has begun on a 10,000 sq ft facility in Long Beach, Cal., for the *Grayson Controls Div., Robertshaw-Fulton Controls Co.*

The Montgomery Co., Windsor Locks, Conn., manufacturer of electric tinsel conductors and silver coated copper wire, has acquired the *New England Electrical Works Inc.*, Lisbon, N.H., manufacturer of specialty stranded and braided wire and cable.

Babcock Radio Engineering Inc. has changed its name to *Babcock Electronics Corp.* to more precisely reflect its manufacture of guidance and control systems for the missile and aircraft industry.

A new electronic and instrumentation wire and cable manufacturer, *Electricable Inc.*, North Hollywood, Cal., has been formed by William S. Garstka, formerly plant manager of *DE Wire Fabricating Corp.*, Lowell, Mass.

Atlee Corp., Waltham, Mass., plans to construct a new plant adjacent to its *Industrial Electronics Div.* plant in Rockland, Mass., for the development and production of relays, transformers, motor controls, and electrostatic spray equipment.

Prices on various "Polypenco" nylon mill shapes have been reduced as much as 15 percent by *The Polymer Corp. of Penna.*, Reading, Pa.

New London Tape Distributors Inc., Niantic, Conn., has been named by the *Marblette Corp.*, Long Island City, N.Y., to service users of plastics materials in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Plans have been made for expanding the operations of *Napco Plastics Inc.*, Napoleon, Ohio, supplier of custom injection molded plastics. All the outstanding stock of Napco was recently purchased by *Eureka William Corp.*, which in turn merged with *National Union Electric Corp.*, now the parent company.

Applied Engineering Products Co., Salt Lake City, has been designated as sales representative in Colorado and Utah for *Phalo Plastics Corp.*, Shrewsbury, Mass., manufacturer of insulated wire, cable, and cord sets.

The *Electronics Div.* of *Chance Vought* is establishing a $3.5-million facility for the production of electronics systems in the Great Southwest industrial district between Dallas and Fort Worth, Texas. Construction of a $1.5-million, 80,000 sq ft building has begun. Special equipment valued at approximately $2-million will be installed.

W. D. Gamble and Co., Pittsburgh, has been appointed sales representative for electrical tapes in West Virginia and western Pennsylvania by the *Boston Woven Hose & Rubber Div., American Biltrite Rubber Co.*, Boston.

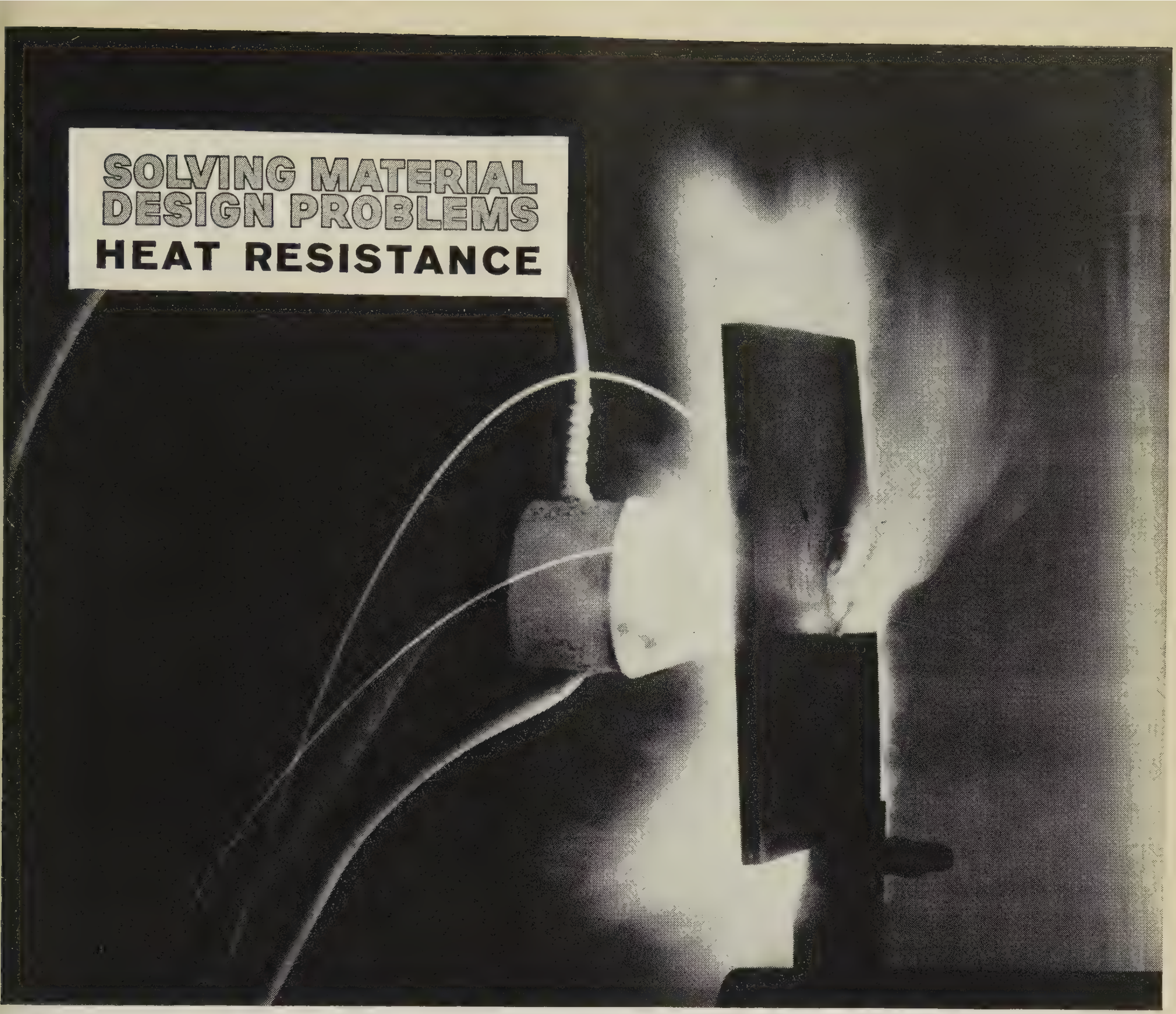
A plant in Spartanburg, S.C., has been purchased by *Insulating Fabricators Inc.*, East Rutherford, N.J. Named *Insulating Fabricators Inc., Southern Div.*, it will fabricate plastic sheets, rods, and tubes and also act as a distributor for plastics materials.

Merger negotiations are being conducted by *Hiller Aircraft Corp.* and *The Electric Autolite Co.* Hiller is active in aircraft development and other military research projects. Autolite makes automotive, aircraft, and electrical products.

The *Magnavox Co.*, electronics manufacturer, recently dedicated new *Magnavox Research Laboratories* in Torrance, Cal. The laboratory, on a 20-acre site, is a division of Magnavox's *Military and Industrial Electronics Div.*

Multi-Amp Electronic Corp., Union, N.J., manufacturer of electrical test instruments and power supplies, has appointed three new representatives: *C. B. Anderson Electric Co.*, Tulsa, Okla.; *Wrathall & Krusi Inc.*, San Francisco; and *International Engineering Co. Ltd.*, Bangkok, Thailand.

SOLVING MATERIAL DESIGN PROBLEMS
HEAT RESISTANCE



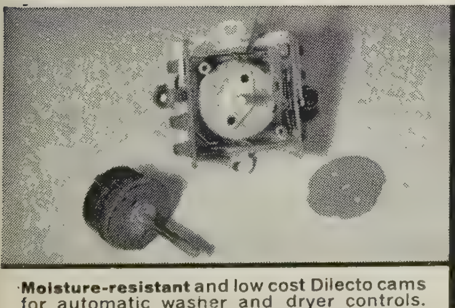
A 5000° flame takes ten minutes to penetrate a one-quarter inch piece of CDF's new Dilecto RD-105 laminate. The same thickness of cold-rolled steel is pierced in less than forty seconds.

Molded from graphite fabric impregnated with a heat (ablation)-resistant phenolic resin, new CDF grades RD-105 and RD-115 are being evaluated in solid propellant rocket motors.

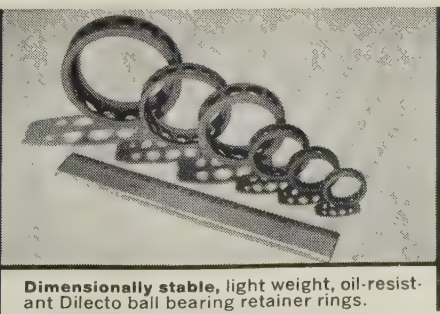
Dilecto laminates are only one family of products from industry's largest selection of non-metallic structural materials and electrical insulations. Vulcanized fibre, silicone rubber and mica, and thermosetting moldings are also supplied by CDF.

CDF can provide both quality and true economy in selecting plastic materials best suited to your needs. Refer to SWEETS PD file or write to us for General Folder 60.

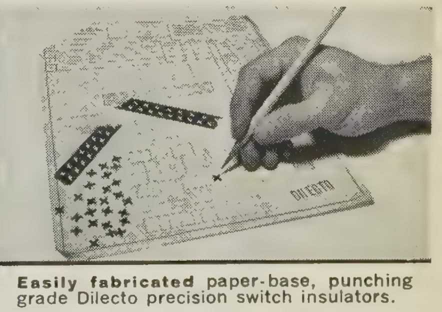
CONTINENTAL-DIAMOND FIBRE
A SUBSIDIARY OF THE Budd COMPANY • NEWARK 17, DEL.
In Canada, 46 Hollinger Road, Toronto 16, Ont.



Moisture-resistant and low cost Dilecto cams for automatic washer and dryer controls.



Dimensionally stable, light weight, oil-resistant Dilecto ball bearing retainer rings.



Easily fabricated paper-base, punching grade Dilecto precision switch insulators.

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Card for Advertisement on Pages 52 & 5

revolutionary breakthrough in magnet wire!

Now one film wire can replace six or more standard films . . .

IT'S PHELPS DODGE POLY-Thermaleze

It's possible because POLY-THERMALEZE combines the best properties of:

FORMVAR® (105C)	High abrasion—no heat shock
NYFORM (105C)	Windability—varnishability—no heat shock
EPOXY (120C)	Compatibility
NYLEZE® (130C)	Windability—varnishability
THERMALEZE B® (130C)	High cut-through resistance
THERMALEZE F® (155C)	High thermal life—high dielectric

Another Example of Phelps Dodge Applied Research!

In developing **POLY-THERMALEZE**, the industry's first multipurpose magnet wire, Phelps Dodge has made a major contribution to the electrical equipment field. This polyester film wire combines the outstanding properties of six or more conventional wires for motor, coil, dry type transformer use. **POLY-THERMALEZE** does not sacrifice one property for another—is completely balanced in all. It offers a ready means of reducing cost by standardizing inventory to one wire for most applications.

Any time your problem is magnet wire,
consult Phelps Dodge for the quickest, surest answer!

FIRST FOR
LASTING QUALITY—
FROM
MINE TO MARKET!

PHELPS DODGE COPPER PRODUCTS CORPORATION

PHELPS DODGE COPPER PRODUCTS
CORPORATION
INCA MANUFACTURING DIVISION
FORT WAYNE, INDIANA

New Publications

ASESA Information

The following notices describe actions recently taken by the Armed Services Electro-Standards Agency, Fort Monmouth, N.J. Printed copies of the actions are not yet available.

MIL-W-583B, Wire, Magnet, Electrical. Supersedes MIL-W-583A with several significant changes, including the addition of several new types.

MIL-C-25C, Capacitors, Fixed Paper-Dielectric, D-C, (Hermetically Sealed in Metallic Cases). With several detail specifications, it supersedes MIL-C-25A, MIL-C-0025B (USAF), and associated detail specifications.

MIL-P-13949B, Plastic Sheet, Laminated, Copper Clad (For Printed Wiring). Supersedes MIL-P-13949A and MIL-P-21466(Aer) with changes and additions.

MIL-C-11693B, Capacitors, Feed Through, Radio-Interference Reduction, A-C and D-C (Hermetically Sealed in Metallic Cases). Supersedes MIL-C-11693A and MIL-C-19080 (SHIPS) with changes and additions.

MIL-STD-202B, Test Methods for Electronic and Electrical Component Parts. Revision B changes and adds to the standard.

MIL-T-27A, Transformers and Inductors (Audio, Power, and Pulse). Amendment 3 makes several changes in the basic specification.

MIL-R-26C, Resistors, Fixed, Wirewound (Power Type). Amendment 1 changes and adds to the basic specification.

MIL-F-15733D, Filters, Radio Interference. Supersedes MIL-F-15733C and MIL-F-18344A (SHIPS)

MIL-R-19365C, Resistors, Adjustable, Wirewound, Power. Supersedes MIL-R-19365B (SHIPS).

MIL-C-3965B, Capacitors, Fixed Electrolytic (Tantalum). Amendment 1 and 12 and associated detail specifications contain many changes and additions.

MIL-R-5847D, Rubber, Silicone; Low- and High-Temperature and Tear Resistant. Supersedes MIL-R-5847C.

MIL-M-20693A, Molding Plastic, Polyamide (Nylon), Rigid. Revision A supersedes MIL-P-20693 and those sections concerned with the characteristics of the basic material in MIL-P-17091B and MIL-M-19098 (SHIPS).

MIL-C-15305B, Coils, Radio Frequency: and Transformers, Intermediate Frequency and Radio Frequency. Supersedes MIL-C-15305A.

MIL-C-17C, Cables, Radio Frequency; Coaxial, Dual Coaxial and Twin Conductor. Changes have been made in Military Specification sheets MIL-C-17/16A, MIL-C-17/17A, MIL-C-17/40A, and MIL-C-17/45A.

MS75009A, Bracket Assembly, Resistor (Power Type). Revision A adds list of tubular tap-type resistor styles of MIL-R-19365C to the table of military standard part numbers for the bracket assembly and its separate components.

MIL-C-3655A, Connectors, Coaxial, Radio Frequency, Series Twin, and Associated Fittings, General Specification for. Revision A deletes qualification approval requirements and reflects latest packaging and packing requirements.

MIL-A-27434, Adapters, Connector, Coaxial, Radio Frequency, Between Series, General Specification for. A new specification covering weatherproof adapters having a nominal impedance of 50 ohms and intended for use in radio-frequency applications up to 10,000 megacycles per second.

A Method for the Dynamic Determination of the Elastic Dielectric Piezoelectric Constants of Quartz, by S. A. Basri. Monograph presents derivations of expressions for the frequency of longitudinal vibration of rectangular bars, and thickness shear vibration of infinite plates (taking into account the piezoelectric effect) and applies them to the determination of the constants of quartz. 22 pages, 15 cents.

Qualification Information for Manufacturers, dated 1 June 1960. Supersedes the issue dated 21 December 1959 and adds procedures for: 1) Extension of qualification to include additional manufacturing location(s). 2) Plant move from one plant location to another. 3) Design-and-construction change(s) in qualified products. 4) Qualification of rebranded product by sole distributor. 5) Listing of U.S. manufacturers' products on Canadian approved products list. It also revises the procedure for qualification testing at a government or government-contracted laboratory. Request copies from Director, ASESA, Fort Monmouth, N.J., Attention: SED.

NEMA Standards

The following new and revised standards publications may be ordered from the National Electrical Manufacturers Association, 155 East 44th St., New York 17.

EI 15-1960, AEIC-EEI-NEMA Standards for Thermal Demand Meters. Covers general service type thermal watt demand meters and watt-hour-thermal watt demand meters. 50 cents.

EI 17-1960, AEIC-EEI-NEMA Standards for Watthour Meter Sockets. Covers die-cast, stamped, ring and box or trough-type watthour meter sockets rated at 200 amperes or less and 600 volts or less, a-c, for use with standard detachable-type watthour meters, demand meters, time switches, instruments, and similar devices or combinations. 75 cents.

FB 1-1960, Conduit and Cable Fittings and Accessories. Covers fittings and accessories for flexible metallic conduit, service entrance cable, armored cable and non-metallic sheathed cable, also certain accessories for rigid conduit and electrical metallic tubing. 40 cents.

SG 2-1960, High-Voltage Fuses. Revised book covers distribution cutouts and distribution oil cutouts, their fuse links, distribution enclosed single-pole air switches, power fuses and current-limiting resistors. $3.

Print Ins. 29 on Reader Service
Card for Advertisement on Pages 52 & 53.

"Is that the new Norton catalog?"

You bet it is!

It's dog-eared and marked up because it's in constant use by men who want better materials — high purity refractory materials which will stand up under the most extreme thermal, mechanical, chemical, electrical, and radioactive conditions.

This valuable, well-illustrated reference describes in detail the many Norton refractory materials which are helping to solve widely different product and processing problems. Uses range from aiding chemical reactions to stopping neutrons, handling molten metals, protecting rocket engines — and taming lightning.

Catalog lists physical, chemical and electrical properties of CRYSTOLON* Silicon Carbide, ALUNDUM* Aluminum Oxide, MAGNORITE* Magnesium Oxide, NORBIDE* Boron Carbide, and Fused Zirconia. It's thought-provoking...a real "idea-starter!"

You may well profit from this book in solving your own processing problems. No charge or obligation, of course, write for "Norton Refractory Grain,"

NORTON COMPANY, Refractories Division,
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REFRACTORIES
Engineered . . . ℞ . . . Prescribed

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

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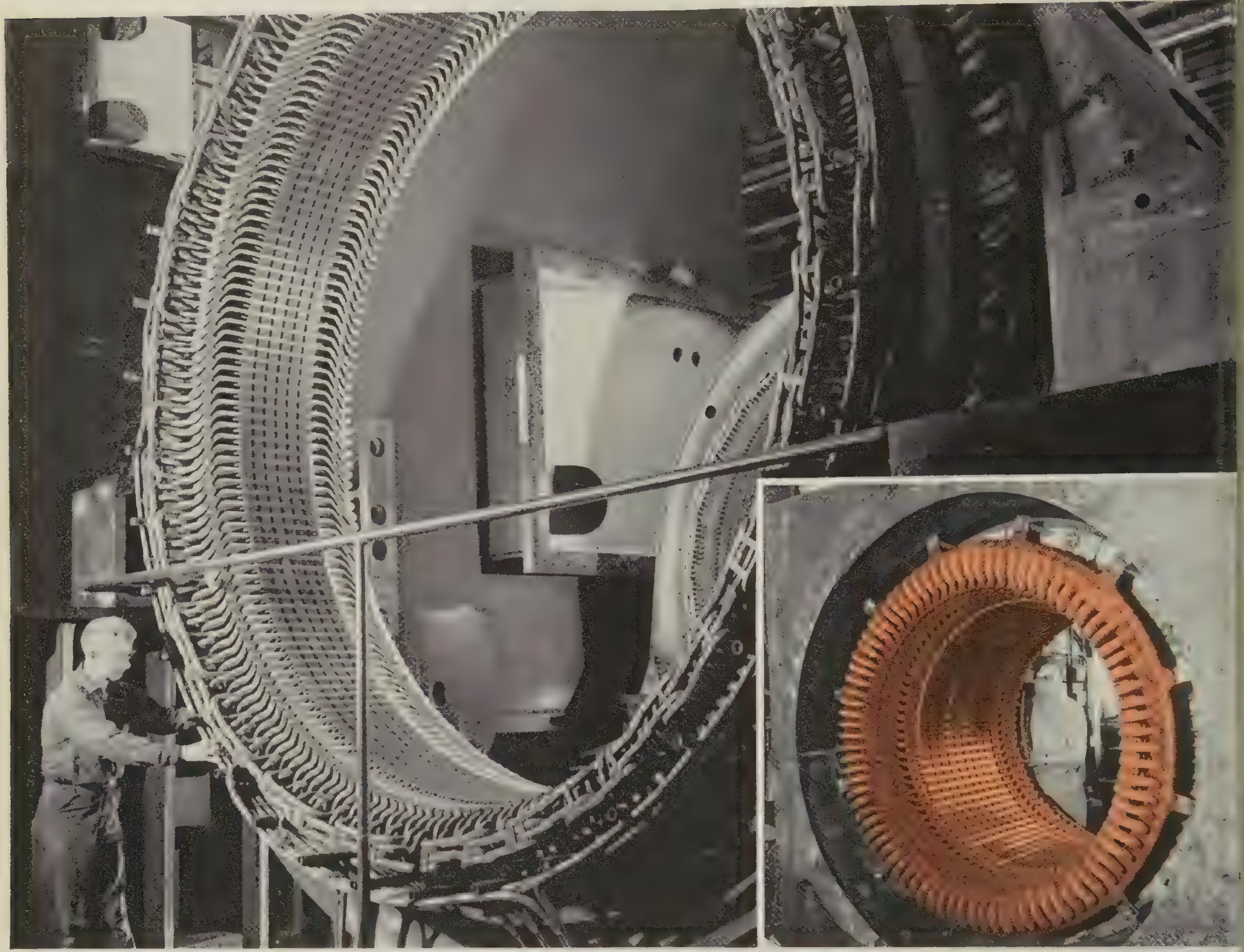
SILICONE NEWS from Dow Corning

For Greater Reliability



Potential for Insulation Systems Made From Silastic Goes Up and Up!

Insulation systems made from Silastic®, the Dow Corning silicone rubber, are being used on more and more machines, on machines designed for higher and higher voltages.

Take the 4,500-kw, 4,160-volt engine-type generator shown above, for example. Built by Allis-Chalmers, this generator features an insulation system made from Silastic.

A midwest steel mill specified silicone rubber insulation for the 11,000-volt, 3,000-hp, Allis-Chalmers Type AKG sintering-fan drive-motor shown in the inset because of outstanding performance from similar motors designed for voltages ranging from 240 to 6,600.

Combining high temperature resistance with self-protecting qualities, insulation systems made from Silastic are winning increased acceptance for equipment subjected to moisture, heat and thermal cycling.

Silastic retains excellent electrical and physical properties from −90 to 250 C., resists arcing, ozone, corona. Vulcanized in place on coils, it forms a homogenous insulation jacket that is impervious to moisture and other contaminants. Resilient, it is unaffected by thermal cycling . . . hairline cracks do not develop.

For the best in silicone rubber insulation, specify Silastic.

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

Dow Corning

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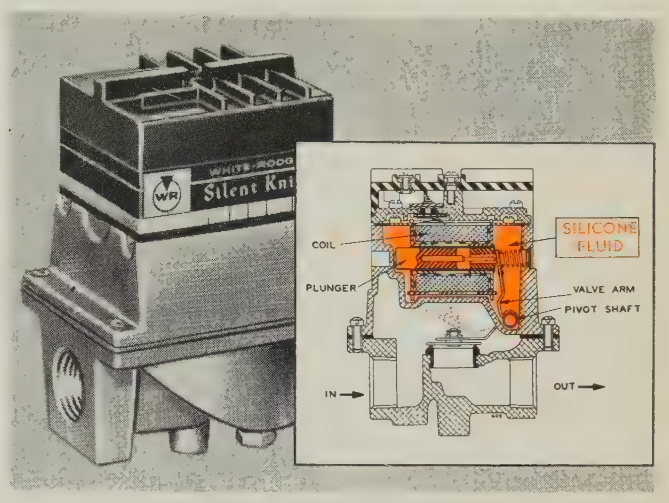
...Design with Silicones

Silence Solenoids with Silicones

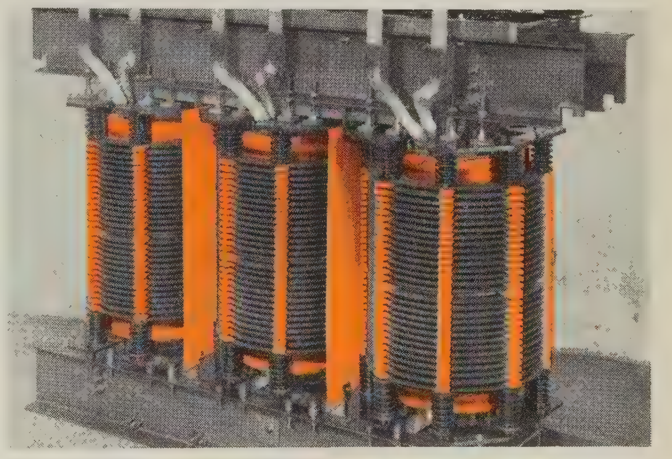
The entire operating mechanism of their new Silent Knight Gas Valve, manufactured by White-Rodgers Company, St. Louis, is immersed in Dow Corning 200 Fluid. Enclosed in an unbreakable metal case, the viscous fluid slows the mechanism, cushions the components and makes them silent. Eliminated are the characteristic "snap" of the relay, the "hammering" of the plunger, some of the undesirable "pop" of gas ignition. Silicone fluid is the ideal damping medium because it doesn't thicken or thin with temperature changes, has excellent dielectric properties. Noncorrosive, resistant to oxidation and to breakdown under shear, Dow Corning silicone fluid assures long-time, reliable service.



Print Ins. 31B on Reader Service Card

Cut Weight with Silicone Laminates

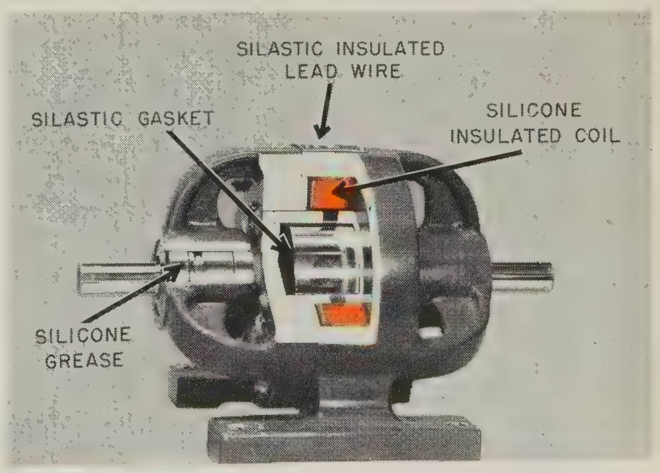
Insulation components made from silicone-glass laminates help improve the design and performance of electrical equipment like this 100-kva, 3-phase Pennsylvania Transformer. Bonded with heat-stable Dow Corning silicone resins, glass laminates have high arc resistance, low loss factor, low moisture absorption . . . excellent mechanical and dielectric strength even after prolonged aging at 250 C. Used with other silicone insulation components, silicone-glass laminates permit transformer designs that are lighter in weight, smaller in size, easier to install and maintain than transformers using any other class of insulation.



Print Ins. 31C on Reader Service Card

For Teamwork Specify Silicones

This magnetic clutch, produced by Vickers Incorporated, Electrical Products Division, Sperry Rand Corporation, assures smooth acceleration of rotating equipment without chatter or grab. Since the Magneclutch can slip continuously, heat is produced. One critical component requiring silicone protection is the excitation coil which produces the torque-producing magnetic field. Insulated with silicone components, and dipped in Dow Corning 997 Varnish, it permits operating temperatures of 180 C and better. Other Dow Corning silicone materials in the Magneclutch: mechanical gaskets, lead wire insulation, bearing lubricants.



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CORPORATION MIDLAND, MICHIGAN

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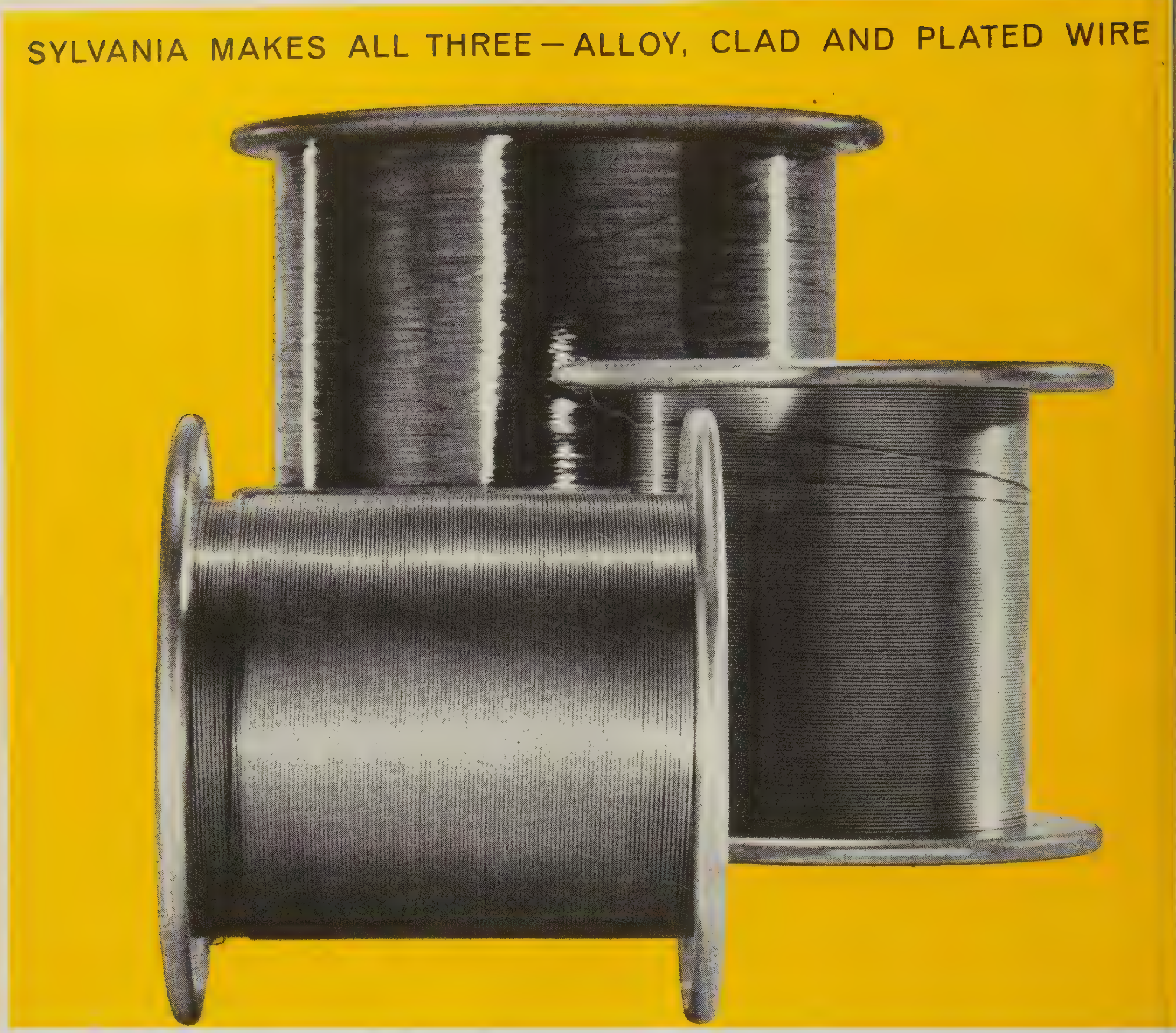

How to speed up design of new products

—call Sylvania for an unprejudiced recommendation on wire

With design time for high-temperature equipment so much at a premium, it pays *not* to get bogged down by noncreative engineering details. Case in point: selecting wire to meet specific conductivity needs in corrosive or oxidizing atmospheres.

You can save valuable time by calling on Sylvania for a wire recommendation. You see, Sylvania knows wire—knows the particular advantages of each kind. And of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated. Available in a complete range of sizes—.002 to .250, retains optimum characteristics at temperatures up to 1600° F.

Result? Your Sylvania wire recommendation is unbiased. It's based on *your* design's needs and is not restricted by a limited line. You can get full details for future use—or timesaving help on your present project—by writing Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

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GENERAL SYSTEM

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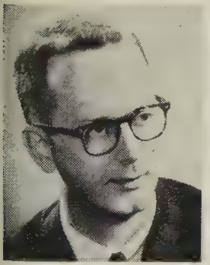
People in the News

A. Shirley Gray has been elected general manager of The Macallen Co. Inc., Newmarket, N.H., mica producer, and of Insulation Manufacturers Corp., Chicago insulation distributor and fabricator, to succeed the late Louis B. McCarthy. *Louis B. McCarthy Jr.* succeeds his father as director of both companies. *William H. Banks* will be resident manager of Macallen and *John E. Johnston* was elected treasurer of Macallen and assistant treasurer of IMC.

William J. Shea has retired as vice chairman of the board, Essex Wire Corp., Fort Wayne, Ind. With the corporation nearly 30 years, he will continue as a member of the board of directors and as a consultant.

Adrian A. Buck Jr., New York district representative of Continental-Diamond Fibre Corp., Newark, Del., insulation manufacturer, for nearly 30 years, passed away unexpectedly recently. CDF, a subsidiary of The Budd Co., has promoted *Peter W. Cummins* to manager of product planning and market research. He had previously been supervisor of market research.



P. W. Cummins

G. A. Schupp

The Magnavox Co., Fort Wayne, Ind., has appointed *George A. Schupp* director of engineering for the consumer products division. He previously was manager of advanced product development at General Electric Co.

Joseph F. Bolger has been appointed New England area field sales engineer for Wiggins Connectors, manufacturer of electronic and fluid connectors.

Spaulding Fibre Co. Inc., Tonawanda, N.Y., has promoted *Edward C. Leitz*, former assistant marketing manager, to director of sales administration, and *John E. Miner*, who was director of liaison engineering, to director of sales promotion.

E. C. Leitz

J. E. Miner

Joseph W. Selden has been elected divisional vice president for the Chemical Div., Minnesota Mining and Manufacturing Co., St. Paul, Minn.

M. Lloyd Bond has been elected chairman of the board and chief executive officer of Northeastern Engineering Inc., Manchester, N.H., switchgear and controls manufacturer. He was manager of special products at ACF Electronics Div., Atlantic Research Corp., which acquired Northeastern recently.

At Coast Pro-Seal & Mfg. Co., Pasadena, Cal., manufacturer of sealants, coatings, and adhesives, *Duke Withrow* has moved up from electronic division products manager to sales manager, chemical division.

D. Withrow

M. Cagen

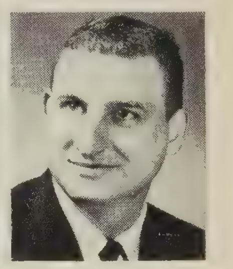
Previously associated with Olin-Mathieson and Heyden Chemical Corp., *Melvin S. Cagen* has been appointed plant technical superintendent of The Cordite Co., Div. of National Distillers and Chemical Corp., Macedon, N.Y.

At Trent Inc., Philadelphia manufacturer of industrial radiant heating equipment, chief engineer *George Conner* has been given the additional responsibility of directing all engineering field activities.

In the Research and Development Div., American Machine & Foundry Co., New York City, *Arthur L. Barber Jr.* has been appointed to the newly created position of director of new products, and *John H. Nason* has been named manager of commercial development. Barber was formerly president of Flexabar Corp., Rockleigh, N.J., and Nason was vice president and general manager of COG Minerals Corp., a subsidiary of Colorado Oil & Gas Corp.

Charles C. Colozzi has been elected president of the United States Gasket Co., Plastics Div. of Garlock Inc. With the company since 1953, he most recently served as plant manager.

C. Colozzi



R. Golz

Equipto Electronics Corp., electronic hardware manufacturer, has appointed *Robert L. Golz* manager of its plant in Naperville, Ill. He previously was assistant to the plant manager, Emcor-Ingersoll Products, Div. of Borg-Warner.

Joseph D. Bianco has left his position as plant manager of Hughes Aircraft Company's Vacuum Tube Products Div., Oceanside, Cal., to become sales manager of Components for Research Inc., maker of potted and encapsulated electronic assemblies.

Norman J. Regnier has been named program manager for an advanced semiconductor reliability study being conducted by Motorola Semiconductor Products Div. for Autonetics, Phoenix, Ariz., a Div. of North American Aviation Inc., as part of the Minuteman ICBM program. *John R.*

NEW DEVELOPMENT IN CLASS B INSULATION

DM-70
DM-100

Dacron Mat
Dacron Mat
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Dacron* Mat (Epoxy Treated) —
Mylar* Combinations

New Milamat Composites Outperform Other Class B Materials And Reduce Insulation Costs

TESTED — by U. S. Naval Research and Industry Laboratories
APPROVED — by Bureau of Ships, U. S. Navy
ADOPTED — by leading motor and transformer manufacturers

NEW IMPROVED BONDING QUALITY
NEW INDEFINITE SHELF LIFE
NEW LOWER PRICES

for
Layer insulation
Phase insulation
Slot insulation
Coil spacer insulation
Other applications where varnished glass cloth is normally used.

These new Class B combinations and constructions were developed by Milam to fulfill a functional and economic need long required by the electrical industry. DM—70 and DM—100 have excellent heat aging or thermal stability, good chemical resistance and high physical strength. They are extremely insensitive to moisture, which reduces leakage substantially. Dielectric strength is high, depending upon total thickness of the combination. Thicknesses range from .005" to .020".

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*Dacron—Du Pont's trademark for its polyester fiber. *Mylar—Du Pont's trademark for its polyester film.

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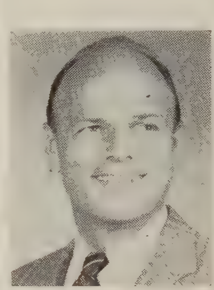
Welty has been named product manager for diodes and rectifiers in th same division.

Peter J. Neroni has been name Midwest sales manager for the Dayton Dayflex Plastics Co., a division o Dayco Corp., with headquarters i Cleveland. Dayflex makes electric appliances and plastic products.

Dodge Fibers Corp., Hoosick Fall N.Y., has named *S. Whitney Dicke* manager of distributor sales. He wi form and administrate an organization of manufacturer's representative to sell heat-resistant electrical insulation, tapes, and other products. *Wi liam Petitt*, with Dodge Fibers sinc 1956, has been named manager c technical sales to electrical equipmen manufacturers and others.


S. Dickey

W. Petitt

Carl E. Drugge has been appointe works manager of the Compton (Lo Angeles), Cal., plant of the Borde Chemical Co., a Div. of The Borde Co. Compton produces a wide rang of urea and phenolic resins, polyviny acetate emulsions, casein product and vinyl extrusions for electrical insulation.

Paul E. Doucette, who has specia ized in the application of epoxy resin at Electric Autolite for the past fou years, is now in charge of the produc development program on molding an pelletizing powders at Hysol Corp Olean, N.Y. *Harry Shwerz*, a chemist is also working on applied researc projects in the R & D department.

FXR Inc., manufacturer of microwave components, test instruments and other electronic units, has forme a board of technical advisors composed of eight scientists. *Dr. Paul D Coleman*, professor of electrical engineering, University of Illinois, i chairman. The other members ar *Dr. R. V. Jones*, assistant professor o applied physics, Harvard U.; *Dr Arthur Oliner*, research professor o

Announcing the NEW

HUD-PAK

HIGH SPEED WIRE PAYOFF PACKAGE

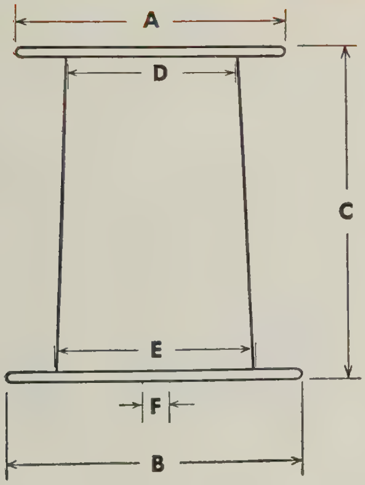
Are You Looking For High Quality Bare Or Coated Wire In The Most Modern Up-To-Date Package?

- **High Speed Payoffs.**
- **Controlled Tensions For Single And Multiple End Winding Operations.**
- **Large Payoff Packages.**
- **A Rugged Container To Protect Wire In Use Or Storage.**
- **Instantaneous Starts And Stops.**
- **All At Regular Wire Prices.**

The exclusive new HUD-PAK is the most important money-saving development in wire packaging in 20 years. With many conductor and AWG sizes, users report record payoff speeds in excess of 5000 feet a minute. HUD-PAK reduces waste from short spools. Its tapered barrel spool—and absence of inertia found with rotating spools—permit instantaneous starts and stops with no danger of wire shakedown and tangle.

We are currently supplying HUD-PAKS containing bare copper wire, tin plated, silver plated, and aluminum wire. Other types are being developed. Optimum results can be obtained within the size range of AWG 38 to AWG 24.

The term "HUD-PAK" is a trade-mark of Hudson Wire Company



	A	B	C	D	E	F
HUD-PAK 120	10"	11"	13½"	6½"	7½"	1¼"
HUD-PAK 50	8½"	9½"	9⅞"	6"	7"	1¼"

CAPACITIES

MATERIAL	Approx. Weight (lbs.) 120	50
COPPER	120	50
CADMIUM COPPER	120	50
ALUMINUM	37	16
BRASS 70/30	115	48
PHOSPHOR BRONZE	120	50
NICKEL SILVER	115	50
STEEL	107	44

HUDSON WIRE COMPANY
OSSINING DIVISION, OSSINING, NEW YORK
TELEPHONE: WILSON 1-8500

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Northern Plastics Corporation produces over 60 standard grades to meet your requirements for flame retardancy, low power factor @ 60 cycles, arc resistance, cold punching, minimum odor, high insulation resistance and excellent mechanical properties.

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electrical engineering, Polytechnic Institute of Brooklyn; *Dr. Richard Pantell,* associate professor of electrical engineering, Stanford U.; *Brig. Gen. Edwin H. Petzing,* (USA, ret.), a consultant; *Dr. Samuel Silver,* director, U. of California Space Science Laboratory; *Dr. George C. Southworth,* consultant; and *Dr. Thomas E. Tice,* director, Antenna Laboratory, Dept. of Electrical Engineering, Ohio State U.

George P. Regan Jr., president of Regan Industries Inc., has been elected chairman of the board of the electronics and graphic arts equipment company. *Bert I. Graves,* president and founder of B. I. Graves Associates, San Francisco, has been elected a director to fill the vacancy left by the late *G. P. Regan Sr.*

Dr. Earl W. Lane has joined Escambia Chemical Corp., New York City, as manager, new product development, commercial development department.

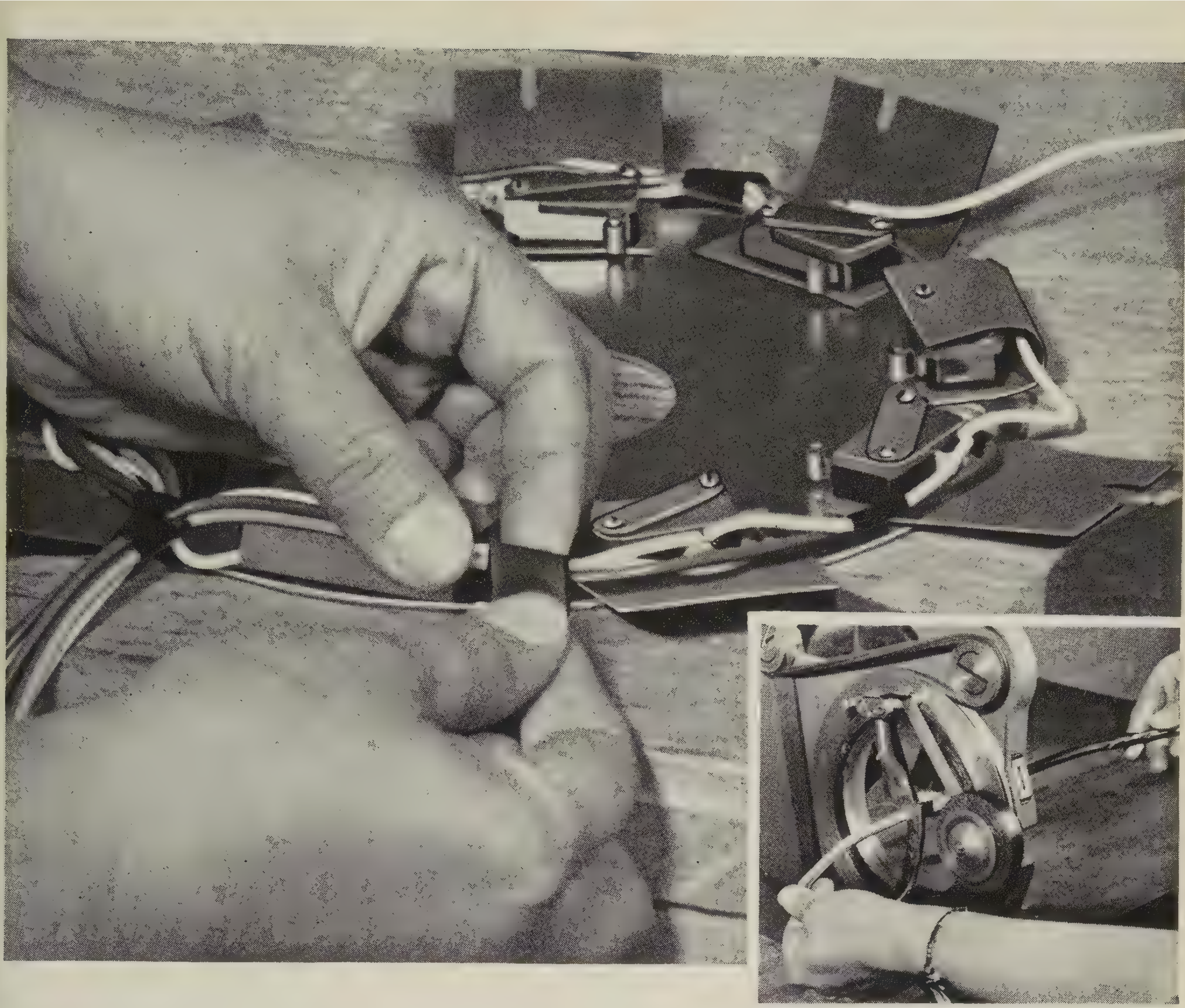
At Formica Corp., Cincinnati laminated plastics manufacturing subsidiary of American Cyanamid Co., *John C. Pitzer* has been named manager of industrial product application in an expanded research and planning department. With Formica since 1924, he formerly was manager of industrial process engineering.

In the Electrical Conductor Div., Kaiser Aluminum & Chemical Sales Inc., Oakland, Cal., *J. Carl Ferguson* has been named director of electrical conductor marketing and *Cornell C. Maier* succeeds him as division general sales manager.

J. Ferguson

C. Maier

The Mica Corp., Culver City, Cal., producer of epoxy glass laminates for etched circuitry, has appointed *Calvin Larsen,* formerly president of Printronics Corp., as manager of its Northern California branch at Palo Alto. Also, new eastern division offices



How Belvidere Manufacturing Co. Made an
80% Cut in Handling and Material Costs!
With J-M Dutch Brand Tape

J-M Dutch Brand Plastic Electrical Tape proved practical and inexpensive for Belvidere Manufacturing Co., of Belvidere, Illinois. High costs made necessary the need for replacement of "zip tubes" which enclosed twin cable harnesses in their Tint-A-Matic Paint Blender. Belvidere and J-M Dutch Brand engineers jointly solved the problem—and cut costs up to 80%—with automatically tape-wrapped harnesses.

Dutch Brand Plastic Electrical Tape may be the answer you seek, too. Providing efficient, low-cost insulation with 150% stretch and ability to conform readily to irregular surfaces, Dutch Brand Plastic Electrical Tape assures maximum versatility and performance.

Size and width varieties, too, permit top tape economy for each job—general usage, heavy duty protection and use with power-driven taping machines, or extra heavy duty where abrasion and wear are encountered.

See how Dutch Brand Plastic Electrical Tape can save you time . . . while it saves you money. Write today for free booklet giving dozens of time-saving uses of Dutch Brand's Big 4 Electrical Tapes.

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JM
PRODUCTS

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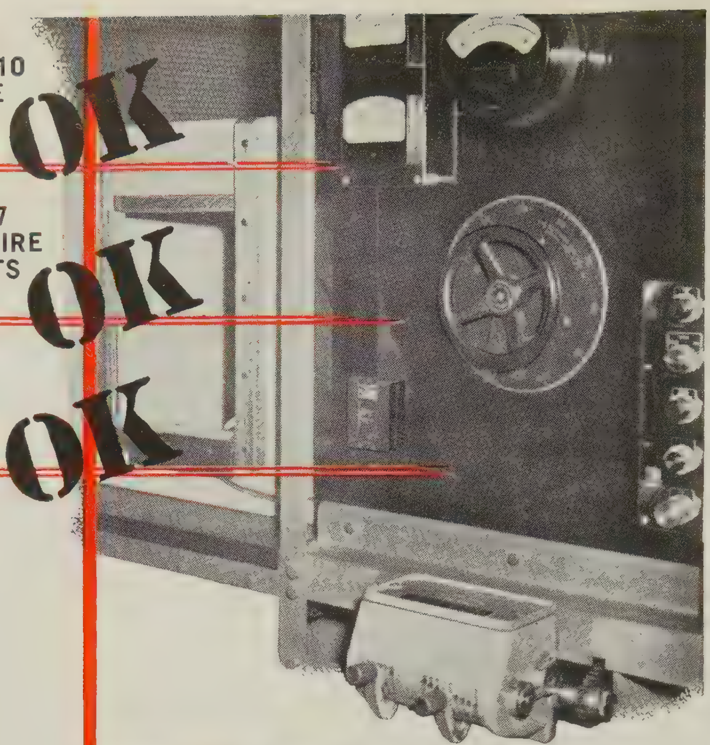
MOTORETTE
TEST

AIEE No. 57
TWISTED WIRE
PAIRS TESTS

CURVED
ELECTRODE
TEST



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takes the guess out of
insulating varnishes

BORTHIG K-3833, One varnish suitable for Class A, B and F applications. A new polyester modified insulating varnish. Motorette test shows more than 30,000-hour life expectancy for Class F temperature operation. Approved for type M, grade CB, MIL-V-1137A.

BORTHIG K-252, years of field experience have established the reliability of this Class B modern type, heat-reactive baking varnish. Motorette test shows 30,000-hour life expectancy. Approved for type M, grade CB, MIL-V-1137A.

BORTHIG K-3829 EPOXY BAKING VARNISH is a thermo-setting varnish which requires no activator and cures entirely by heat induced polymerization. Laboratory tests and field experiences show K-3829 to have higher values for wet and dry dielectric plus excellent bonding strength and corrosion resistance at higher temperatures (up to 165° C). It is recommended to meet the toughest conditions of operations. Motorette testing shows 30,000 hour-life at Class F temperatures (155° C).

Also look to Borthig for the latest in EPOXY RESIN COMPOUNDS for the incapsulation of electric motors, transformers and electronic units.

N.I.S.A.
ASSOCIATE MEMBER

Our laboratory will be pleased to cooperate in any of your insulating problems.

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SUBSIDIARY OF STANDARD TOCH INDUSTRIES, INC.
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2600 Richmond Terrace, Staten Island 3, New York

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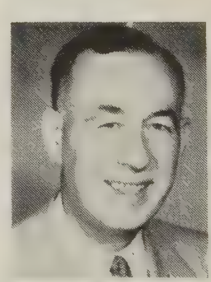
are being set up in Newark, N.J., with *Bernard C. Alzua Jr.*, previously manager and director of printed wiring facilities at Motorola's Military Electronic Center, Phoenix, Ariz., as manager.

Application engineer *Leon Hughes* has been transferred to the staff of Wayne Kerr Corp., Philadelphia electronic measuring instrument producer, from Wayne Kerr Laboratories, Ltd., New Malden, Surrey, London.

Lambda Electronics Corp., College Point, N.Y., regulated power supply manufacturer, has elected *Sol Greenberg* to the newly created post of director of engineering and named *Benjamin Shmurak* to succeed him as chief engineer.

Robert E. Ward has been appointed manager of The Carwin Company's North Haven, Conn., plant which produces specialty isocyanates, high temperature polyurethane foam systems, and organic chemicals.

Oakley N. Dean has been promoted to vice president of manufacturing, Exide Industrial Div., The Electric Storage Battery Co., Philadelphia. With the company since 1949, he moved up from manager of the Philadelphia manufacturing operation.


O. Dean

W. Alden

Porter-Cable Power Tools (Canada) Ltd., Kingston, Ontario, has appointed *William S. Alden* managing director.

Norton Co., Worcester, Mass., manufacturer of electro-chemical and other products, has appointed *Robert H. Gow* as supervisor of industrial engineering in the crushing plants, and *Ercell R. Stevens* as abrasive grain engineer in the West Coast district. At Worcester, *Andrew B. Holmstrom* has retired as vice president of the company and three new supervisors have been named: *James E. Haggett*, industrial engineering department;

SX

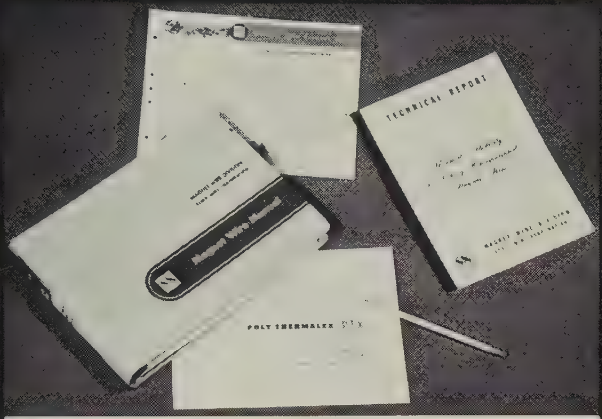
REPORT FROM

ESSEX MAGNET WIRE LABORATORIES*

*TECHNICAL INFORMATION CENTERS FOR RESEARCH, DEVELOPMENT, VALUE ANALYSIS AND ENGINEERING.

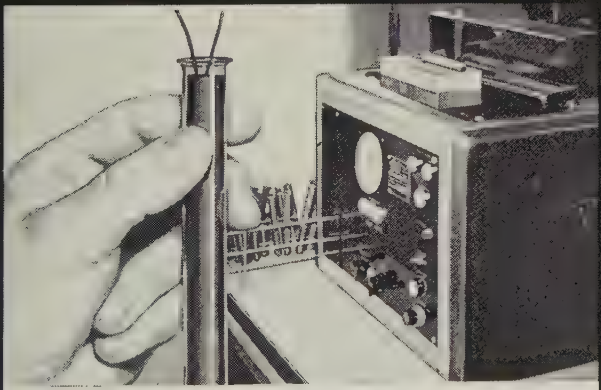
Here's how Essex can help you solve your magnet wire problems with

Plus 4 CUSTOMER APPLICATION SERVICE



+1 **SX Technical Reports** give thorough coverage of physical properties and applications of magnet wire types. Keep you abreast of progress and development.

+2 **Research and Development** at SX helps you by keeping its eyes on the future. There is continuous development of improved insulating materials and processes. Such technical progress serves you with constantly improved magnet wire.



+3 **Testing Facilities** support research at SX as part of a complete system giving you assistance on any magnet wire problem, whether it concerns product or application. A library of specifications are available in our laboratories for your use.

+4 **Field Help on the Job** by experienced SX sales and technical staff is the final step in Essex Plus-4 service to help you solve application problems at a saving. Seminars and symposiums also keep you abreast of latest developments.

For Plus 4 *application service consult your Essex Magnet Wire salesman, or write direct stating your problem.*

MAGNET WIRE DIVISION, Essex Wire Corporation, Fort Wayne, Indiana

MANUFACTURING PLANTS: Anaheim, California; Fort Wayne, Indiana; and Hillsdale, Michigan

National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man"

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Ceramic
Engineer
Chemist
Or
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To head research
and development
of
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Submit résumé to Dave Graef

**CANNON
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2801 East Airlane,
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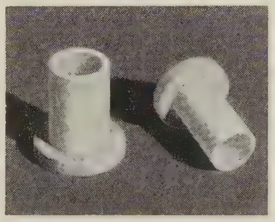
25 years of progress in tiny parts

GRC



**GRC MOLDED NYLON
SCREW INSULATORS**

These insulators and bushings are designed with wide flanges — larger than the head size of all standard commercial screws—so that they will completely isolate the screw from its mounting surface.

Molded of nylon they have a low dielectric constant, relatively high dielectric strength . . . resist high voltages at commercial frequencies . . . are particularly suited for screw insulator application, where high tensile and torque requirements call for non-insulating screws. Naturally elastic and resilient, they can also be used as light-load bearings.

Available from stock in 1/4" and 3/8" lengths for use with screw sizes No. 4 thru 1/4".

SCREWS
HEX NUTS
WASHERS
INSULATORS & BUSHINGS
COIL BOBBINS
WIRE TIES
WIRE CLAMPS

Write now for samples, prices and new GRC Fastener Catalog

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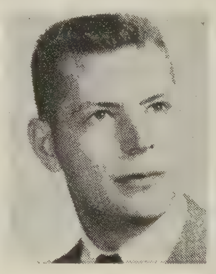
Marshall W. Greene, manufacturing control department, crushing plants; and *Alan F. Howe*, process engineering department, crushing plants.

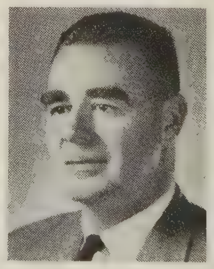
Gries Reproducer Corp., New Rochelle, N.Y., has appointed *R. E. Anderson*, Minneapolis, exclusive sales representative for its stock components, plastic moldings, and die castings in Minnesota, North and South Dakota, and western Wisconsin.

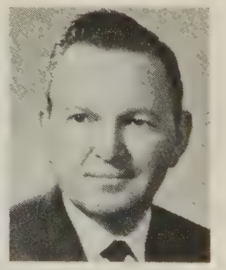
Hermann K. Intemann, president of Union Carbide Metals Co. since 1957, has been named director of purchases for Union Carbide Corp.

The General Electric Co. has appointed *William D. Trammell* sales representative for the western district of the Silicone Products Dept., Dallas, Texas. At Waterford, N.Y., *Harold W. LeBoeuf* has been named manager of manufacturing for the Silicone Products Dept., succeeding *Dr. James R. Donnalley* who recently assumed the post of general manager of the Insulating Materials Dept., Schenectady. *Frank E. Brewster* has been named manager of intermediates to succeed LeBoeuf. At the Insulator Dept., Baltimore, Md., *H. M. Carmichael* and *T. E. Traugott* have been appointed zone sales managers. Carmichael, with headquarters in Atlanta, Ga., will manage the eastern sales zone. Traugott will head the western sales zone from Burlingame, Cal. A new Los Angeles sales district covering Arizona and the southern sections of California and Nevada has been formed with *P. E. Jorgenson* as district manager. At the Chemical Materials Dept., Pittsfield, Mass., *Richard J. Thompson* has been appointed manager of polycarbonate market development.

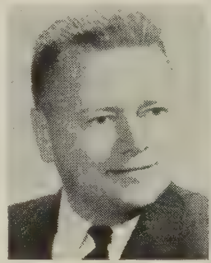

W. Trammell

H. LeBoeuf


H. Carmichael


T. Traugott

Arthur G. Baitz has been appointed to the new post of director of engineering planning for the Robertshaw-Fulton Controls Co., Richmond, Va. In R-F's Aeronautical and Instrument Div., Anaheim, Cal., *Lawrence T. Garnett*, formerly assistant chief engineer of the electronic controls division of Manning, Maxwell & Moore Inc., has been named senior development engineer. And *Kenneth W. Premo*, formerly administrative engineer, has been appointed to a new post as field engineer for the controls firm in the San Francisco Bay area.


A. Baitz

L. Garnett

William F. Palmer has been appointed to the newly created post of manager of advanced circuit development and new product evaluation for the Semiconductor Div., Sylvania Electric Products Inc., Woburn, Mass. Palmer has headed the division's applications engineering section since 1957. The Semiconductor Div. has also appointed *Dr. Pei Wang* to the newly created post of engineering manager in charge of device services, and named *William D. Hogan* to the newly created post of manager of field engineering. At Needham, Mass., *George M. Sokol* has been appointed manager of the MOBIDIC program at the Data Systems Operations. In the Buffalo (N.Y.) Operations, *Gerald C. Johnson Jr.* has been appointed manager of the B-58 Hustler program. And *Dr. Daniel H. Goodman* has been appointed manager of the Mountain View (Cal.) Components Laboratory.

Joseph R. Lewis has been appointed director of engineering for the Sierra Electronic Div., Philco Corp., Menlo Park, Cal. He has been with the company 14 years.

Only NJE... at NO EXTRA COST

... offers 20 SAFETY Features on High Voltage Power Supplies

Only NJE offers the BASIC 20—safety and performance features—as standard equipment on Heavy Duty, Industrial High Voltage Power Supplies. There are 34 standard catalog units available on short delivery time and at economical cost. NJE guarantees quality construction, reliable performance and significant component derating.

Check the specs on just 2 of the 34 available.

Model	DC Voltage	Current	Ripple	Price	Size
H-60	0 to 50,000	5 MA	2% RMS	$1300.	Control: 22″ x 22″ x 18″ *Tank: 27″ x 22″ x 22″
H-80	0 to 120,000	5 MA	2% RMS	$1850.	Control: 22″ x 22″ x 18″ *Tank: 27″ x 22″ x 22″

*Oil not included

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Association News

Eastern Joint Computer Conference To Be Held Dec. 13-15 in New York

The tenth annual Eastern Joint Computer Conference (EJCC) will be held Dec. 13-15 at the Hotel New Yorker and Manhattan Center, New York City. Nathaniel Rochester, International Business Machines Corp., is general chairman of the conference.

SPE Adds 45th Local Section

The Society of Plastics Engineers recently granted a charter to a new Arizona section, bringing to 45 the number of SPE sections now organized in the United States, Canada, Mexico, and Japan. Current membership of the Arizona section includes 39 engineers located primarily in the mushrooming Phoenix-Tucson area, although the section encompasses the entire state.

Officers of the new section are: President—Samuel Windman, Phoenix Plastics; Vice President—Ted W. Kerr, Arizona Plastics Extrusion Co.; Secretary—Don H. White, University of Arizona; Treasurer—Alan C. Bennett; and Councilman — John Chesson, The Swanson Co.

Society of Women Engineers Honors Esther Conwell

Dr. Esther M. Conwell, General Telephone & Electronics Laboratories Inc., Bayside, N.Y., a physicist, housewife, and mother of a four-year-old son, received the annual award of the Society of Women Engineers for "significant contributions" to engineering.

Dr. Conwell was recognized for her work "as a research physicist in the field of solid state research." She has been engaged in this field since graduation from Brooklyn (N.Y.) College in 1942.

AIEE Approves New Section And Two New Subsections

A new section and two new subsections have been formed by the American Institute of Electrical Engineers. The new Central Florida section makes a total of 116 such divisions of the institute. It formerly was part of the Florida West Coast section. Officers are A. J. Farson, chairman, and R. R. Rowell, secretary.

The new Channel Counties subsection of the Los Angeles, Cal., section also has been approved. Officers are E. L. Peterson, chairman, and M. M. Rypins, secretary.

Officers of the new Southeastern Massachusetts subsection of the Providence section are L. H. Faulkingham, chairman, and L. M. Gonsalves, secretary.

Electrochemical Meeting Oct. 9-13

The Electrochemical Society will hold its fall meeting October 9-13 at the Shamrock Hilton Hotel, Houston, Texas. Extensive symposia on batteries, corrosion, electrodeposition, electrothermics, metallurgy, and semiconductors are being arranged.

The entertainment program will feature a deep-sea fishing trip into the Gulf of Mexico on October 9, an outdoor barbeque the evening of October 10, and a post convention tour to Mexico starting the afternoon of October 13.

Marquette Will Participate in National Electronics Conference

Marquette University, Milwaukee, Wis., has been added as a participant of the National Electronics Conference. The 16th annual conference will be held in Chicago at the Sherman Hotel on October 10-12.

Sponsors of the conference are the American Institute of Electrical Engineers, Illinois Institute of Technology, Institute of Radio Engineers, and Northwestern and Illinois Universities.

Other participants in addition to Marquette are the Universities of Notre Dame, Purdue, Michigan State, Wayne State, Michigan, Wisconsin, and Iowa State; Electronic Industries Association; and the Society of Motion Picture and Television Engineers.

More than 10,000 engineers and scientists are expected to view the 275 commercial exhibits in which 250 electronic firms will display their products.

NEMA Annual Meeting, Other News

The 1960 NEMA annual meeting will be held November 17 in the Savoy-Hilton Hotel, New York City, immediately following a series of division and section meetings at the Traymore Hotel in Atlantic City. Divisions which are expected to meet in Atlantic City include Insulating Materials; Generation, Transmission and Distribution Equipment; Industrial Equipment; and Building Equipment.

Six more companies have joined NEMA. They are: The Coleman Co. Inc., Wichita, Kans.; North American Phillips Co. Inc., New York, N.Y.; Saban Electric Corp., Winnisquam, N.H.; Vulcan Radiator Co., Hartford, Conn.; Wheatland Electric Products Co., Pittsburgh, Pa.; and Zenith Electric Co., Chicago, Ill.

New officers of NEMA industry sections include R. R. Titus, president, Synthane Corp., Oaks, Pa., elected chairman of the Industrial Laminate Section, and E. O. Hausmann, vice president, Continental-Diamond Fibre Corp., Newark, Del., elected chairman of the Manufactured Electrical Mica Section.

AIEE Members Elevated To Grade of Fellow

The American Institute of Electrical Engineers has elevated 19 of its members to the grade of Fellow for outstanding contributions to the profession. Among them are:

Frank M. Clark, consulting engineer-insulation, General Electric Co., "For contributions to development of electrical insulation through the application of chemical principles."

Ray D. Jones, liaison engineer, Fort Wayne Laboratory, General Electric Co., "For contributions to extended range and life of small motors, generators and dynamotors for military application."

Marvin Lee, president, Burndy

Higher cut-through temperatures with new Formvar/based enamel

A new FORMVAR based magnet wire enamel has been developed specifically for hermetic as well as general purpose service. The new insulation offers excellent cut-thru resistance . . . up to 300°C . . . your assurance of faultless performance during periods of high overload. Also, it offers outstanding resistance to Refrigerant-22. Plus the same service-proven balance of properties of standard FORMVAR-with-phenolic enamels.

Consider this unequalled combination of key properties:

- Refrigerant-22 extractible content below ½%; excellent blister resistance before and after prebake.
- Excellent moisture resistance as determined by the boiling water test.
- Wet dielectric strength greater than 2000 volts per mil after 24 hour submersion in distilled water.
- Electrical resistance retained at elevated temperatures.
- Thermal life of 60,000 to 100,000 hours at 130°C when overcoated with suitable varnishes.

This new enamel has been well proved in the field. The enamel or coated wire is available from your regular supplier under the FORMETIC or other trademark. Consult him for more details on how this new insulation will pay you real dividends in trouble-free performance.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES NEW YORK CLEVELAND SAN FRANCISCO GREENSBORO ST. LOUIS

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polyvinyl formal by
SHAWINIGAN
RESINS

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HYSOL 15-032, a new flame-retardant epoxy casting system, snuffs out immediately upon removal from Bunsen burner flame.

Non-burning by ASTM D635-56T standards, and self-extinguishing according to MIL-I-16923C and MIL-T-27A tests, HYSOL 15-032 is flexible to withstand thermal shock.

HYSOL 15-032 Flame-Out Epoxy Casting System is recommended for use on transformers and other electrical/electronic components requiring its unique characteristics.

For complete information write for Bulletin E-215.

PROGRESSIVE PRODUCTS THRU CHEMICAL RESEARCH
HYSOL CORPORATION · OLEAN, NEW YORK
Formerly Houghton Laboratories, Inc.
HYSOL OF CALIFORNIA Los Angeles, California
HYSOL (CANADA) LTD. Toronto, Ontario

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Corp., "for contributions to engineering development of electrical connectors and connector tools."

Marion R. Lory, engineering manager, Large Rotating Apparatus Dept., Westinghouse Electric Corp., "For contributions to design of large synchronous motors and electric couplings."

Clarence F. Schwan, Reliance Electric & Engineering Co., "For contributions to design of rotating machinery, especially for high-frequency induction heating."

Charles R. Vail, professor and chairman, Electrical Engineering Dept., Duke University, "For contributions to electrical engineering teaching and to synthetic insulations."

Clark Honored by ASTM

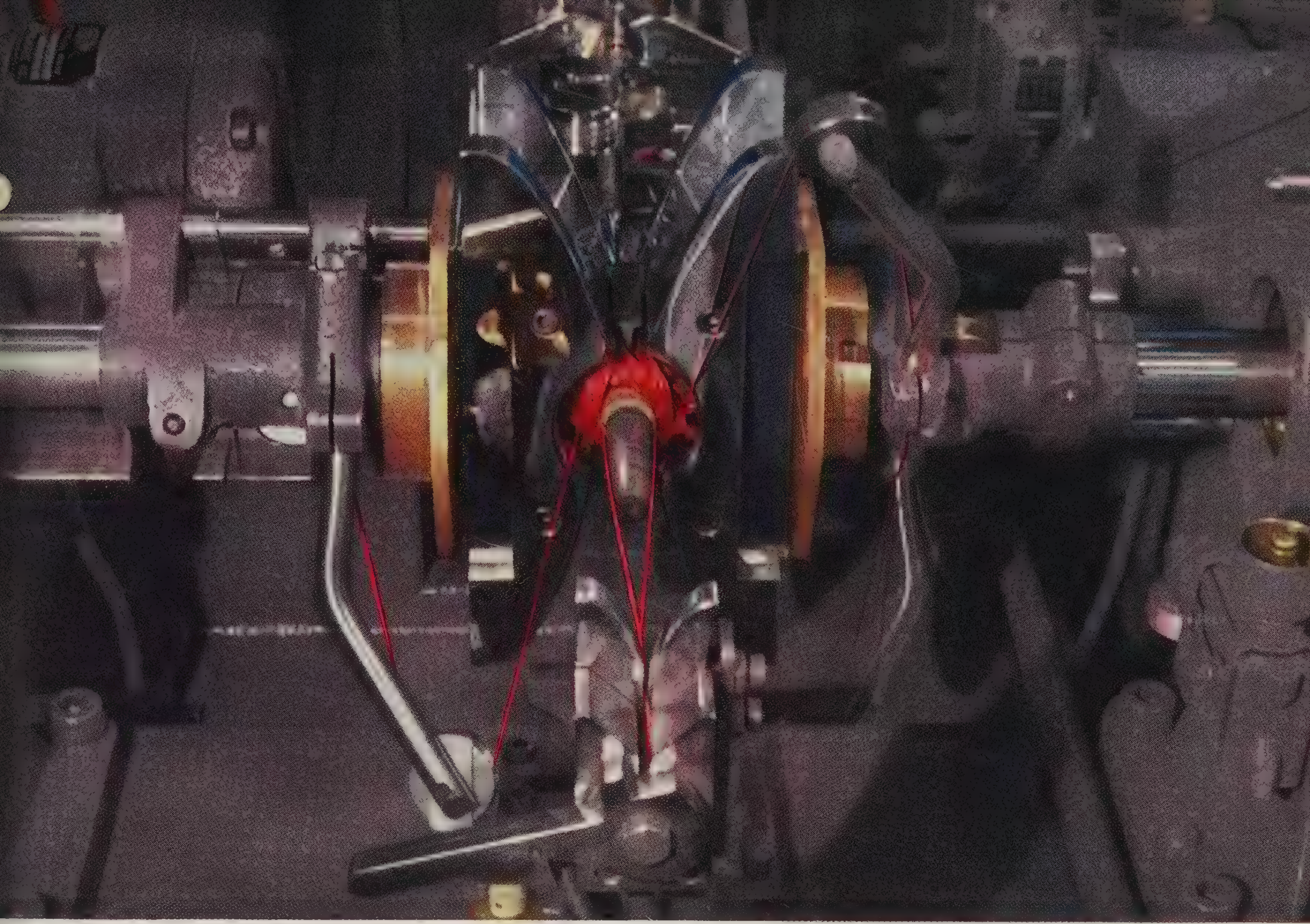
Frank M. Clark, consulting engineer on insulation, General Electric Co., was among 19 men who were given an Award of Merit by the American Society for Testing Materials at its recent annual meeting. Clark was presented with the award in recognition of sustained and outstanding leadership first in Committee D-9 on Electrical Insulating Materials, and subsequently in the newly organized Committee D-27 on Electrical Insulating Liquids and Gases. (Clark has also just been named a Fellow of AIEE.)

New Officers for ASTM, Changes In Staff Responsibilities

A. Allen Bates, vice president of research and development, Portland Cement Association, Chicago, has been elected president of the American Society for Testing Materials. Russell Wade Seniff, manager of research, Baltimore and Ohio Railroad, Baltimore, Md., has been elected vice president for a two-year term. Miles N. Clair, president, The Thompson & Lichtner Co., Brookline, Mass., continues as senior vice president of the society.

Raymond E. Hess, ASTM associate executive secretary, has been named acting executive secretary. Robert J. Painter, executive secretary since 1952, will act as a consultant to the executive secretary in addition to continuing as treasurer of ASTM.

Print Ins. 43 on Reader Service C



For more details on Anaconda Nylac's unique combination of useful characteristics, please turn the page—

When you must wind fast, tight, and meet high temperatures, too,
SPECIFY NYLAC SOLDERABLE MAGNET WIRE

The faster you wind and the tighter your space factor—the more you should consider the advantages offered you by Anaconda Nylac Magnet Wire.

For Nylac is Anaconda Analac with a tough, Nylon film outer covering. The Nylon provides outstanding slipperiness and abrasion resistance—these tight-winding characteristics enable you to make compact, easily shaped, uniform coils.

Yet Nylac incorporates many features of Analac. For example, it gives you easy, fast solderability without stripping. It also has excellent moisture resistance.

In addition, Nylac offers you high dielectric strength, high thermoplastic flow temperatures, excellent flexibility, resistance to hot varnishes and potting compounds. *And—it meets all 130°C (AIEE Class B) requirements.*

So by combining Nylon, an old and industry-accepted insulation, with a newer but thoroughly proven film covering—*Analac*—Anaconda's *Nylac* is a new solderable Class B Magnet Wire especially designed to overcome the strains of today's high-speed winding equipment and tight space factors.

The next time you face these and other winding problems, contact your nearest Anaconda Wire & Cable Sales Office. Our technical staff and Research and Development Laboratory facilities are available to give you every assistance possible. See the Man from Anaconda. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

60253

Ask the man from
ANACONDA®
about
NYLAC MAGNET WIRE

ANATHERM 155°C (AIEE Class F)
high temperature resistance

EPOXY 130°C (AIEE Class B)
superior compatibility

PLAIN ENAMEL 105°C (AIEE Class A)
low-cost enameled magnet wire

FORMVAR 105°C (AIEE Class A)
proven dependability

ANALAC 105°C (AIEE Clas
solderable magnet wire

Important Facts about NYLAC MAGNET WIRE

Anaconda® Nylac film-coated magnet wire has a Nylon enamel outer surface over a film of Anaconda Analac (polyurethane) insulation. Nylac is a solderable wire that meets 130°C (AIEE Class B) thermal test requirements. It has outstanding windability and varnishability for severe process conditions, and exhibits excellent heat shock characteristics.

TECHNICAL PROPERTIES

ELECTRICAL PROPERTIES

Nylac has high dielectric strength. It has excellent electrical properties for all applications except high "Q" coils where dissipation factor should be as low as possible.

DIELECTRIC STRENGTH

Moisture environment of sample	Volts per mil of insulation
Dry	3580
Room Conditions	2560
Six hours at 100% relative humidity at 100°F	1310

DIELECTRIC CONSTANT AND DISSIPATION FACTOR

(Measured with capacitance bridge)

Frequency Cycles Per Second	Dielectric Constant		% Dissipation Factor	
	35°C	100°C	25°C	100°C
10^2	3.5	10.7	2.4	11.4
10^3	3.4	8.9	2.2	21
10^4	3.5	6.2	2.8	18
10^5	3.3	4.8	2.8	6

MECHANICAL PROPERTIES

Nylac is a strong flexible insulation. It adheres well to the conductor. Nylac wire survives severe abrasion, stretch and flexing in high-speed, high-tension winding operations due to the tough Nylon overcoat. The wire will take short radius corner bends without cracking.

CHEMICAL PROPERTIES

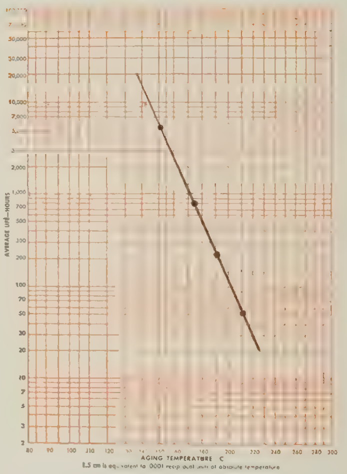
Nylac has outstanding resistance to chemical attack. It will withstand 24 hours' immersion at room temperature in solvents including naphtha, Xylol, ethyl alcohol, chlorothene, methanol, and in 5% sulfuric acid and 1% potassium hydroxide.

THERMAL PROPERTIES

THERMAL STABILITY

Nylac meets the 130°C (AIEE Class B) requirement. Graph 1 indicates 20,000 hours' life at 135°C for unvarnished samples. Varnished sample data, available on request, indicates over 30,000 hours at 130°C.

Nylac is not recommended for use where severe thermal overloads may be encountered.



NYLAC MAGNET WIRE
UNVARNISHED AIEE 57 TEST

HEAT SHOCK
1 HR. AT 155°C

Prestretch	Mandrel Diameter (Multiple of Wire Diam.)			
	1x	3x	5x	10x
0%	pass	pass	pass	pass
10%	pass	pass	pass	pass
15%	pass	pass	pass	pass
20%	pass	pass	pass	pass
25%	pass	pass	pass	pass

Thermoplastic flow temperature

265°C using 5°C per minute rate of rise

SOLDERABILITY

Nylac wires solder without pre-stripping at practical solder temperatures.

Wire Size	Time-Seconds	Solder Temperature	Sample
15—18	15	360°C	Twisted Pair
19—25	10	360°C	
26—30	4	360°C	Wrap on 20 gage mandrel
31—46	4	360°C	

New Nylac Booklet—yours for the asking.
Latest information—full technical data.
Mail coupon for your copy.

ANACONDA WIRE & CABLE COMPANY
25 Broadway, New York 4, N. Y.

am interested in learning more about the excellent properties of Nylac Magnet Wire. Please send me your new technical booklet DM5928.

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COMPANY ....
ADDRESS ....
CITY ..............................ZONE.....STATE..........

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

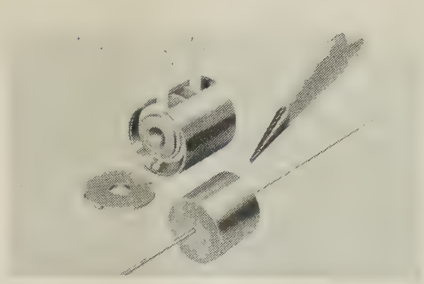
High Temperature Epoxies for Impregnating and Encapsulating

Two semiflexible epoxy powders for continuous operation at class H temperatures, "Maraset" # 135E, an unfilled powder, and # 136E, a filled powder, have been developed for impregnating and encapsulating electrical and electronic equipment such as transformers, coil windings, and other parts. Both are single-component resins that require no catalyst for hardening by an oven cure of 12 hours at 125°C. They are said to provide a smooth, uniform, tough, semiflexible coating which withstands severe mechanical and thermal shock and has good resistance to moisture and chemicals. Both compositions meet federal transformer specifications as defined in MIL-T-27A. They are low-exotherm materials which are liquefied to 110°C prior to being applied by dipping or pouring. They reportedly have four-hour pot life, negligible shrinkage, and a 60% elongation rate. Resin # 135E exhibits tensile strength of 9,000 psi, and resin # 136E 10,000 psi. Working samples of either resin are available at $4 a quart. Further price data and technical bulletins available. Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.

Print No. Ins. 100 on Reader Service Card

Component Encapsulating Shells For Use to 450° F.

A line of new plastic-molded encapsulating shells for precision wire-wound resistors with either axial or radial leads and other components is said to be capable of withstanding continuous operating temperatures as high as 450°F (232°C). Lower moisture absorption, lower cost, and greater strength than those machined from epoxy rods are also claimed for the new shells which are molded to a uniform wall thickness of .002″. The cap that seals off one end is stepped for a tight-fitting press fit. The resistor shells are available in two materials: a mineral-filled alkyd that meets Military Specification M14EMAG, and a diallyl phthalate for high-temperature applications that meets Military Specification 18794SDG. Both materials reportedly have excellent adhesion to the most commonly-used potting compounds, and are superior to epoxy in terms of strength, low moisture absorption, and flame and temperature resistance. They also offer a broader range of more vivid colors. The Milton Ross Co., 237 Jacksonville Rd., Hatboro 56, Pa.



Print No. Ins. 101 on Reader Service Card

New Epoxy Adhesive for Bonding Nylon to Nylon

A new, two-component, 100% solids epoxy adhesive, Hysol 4219, reportedly has proven outstanding for bonding nylon to nylon at room temperature. Surface preparation consists of roughening with emery cloth and wiping with acetone. It is said that 4219 is not affected by immersion in JP4, alcohol, or high flash naphtha. Bulletin A-2042 available. Adhesives and Sealants Dept., Hysol Corp., Olean, N. Y.

Print No. Ins. 102 on Reader Service Card

Modified Cellulose for Films and Molding Has Dielectric Constant of 12.5

A new film-forming and moldable dielectric is claimed to have the highest dielectric constant (12.5) of all known organic film-forming materials. Because of its high dielectric constant and its low dissipation factor, "Cyanocel" chemically modified

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for missile and radar sleevings, cable sleevings, barrier insulation, and similar applications, use large size

Electrical Tubing
MADE FROM
TEFLON*

PF tubing made from Teflon in sizes from ⅜" to 1" for electrical applications is widely used because of:

1. the OUTSTANDING electrical and physical properties of Teflon, including: dielectric breakdown (18,000 volts or greater); lowest dielectric constant (2.0); no change of electrical properties with temperature (−25°C. to +250°C.) or frequency (60 cycles to 100 mc); unaffected by moisture; low coefficient of friction; flexibility; very low permeability.
2. the OUTSTANDING design, engineering and production techniques developed by Pennsylvania Fluorocarbon to assure you of: tubing that is consistently uniform in dimensions; prompt deliveries; the tailoring of Teflon with colors for identification or with modifications for improved texture and mechanical properties; competitive prices.

Write, wire or call for a prompt quotation on your needs.

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FLEXITE®

SILICONE RUBBER

EXTRUDED TUBING

*D*o your requirements call for an insulating tubing with outstanding flexibility; high tensile strength, elongation, and tear strength; excellent resistance to corona, oils, and the effects of weather; and rated for continuous use at 200°C? Then specify Markel FLEXITE SR Silicone Rubber Extruded Tubing, a recent addition to the Markel *Line of Excellence* in sleevings and tubings. Ask for additional data and test samples.

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SINCE 1922
1 SOURCE *for* EXCELLENCE *in*
Insulating Tubings, Sleevings, and Lead Wire

NORRISTOWN, PENNSYLVANIA
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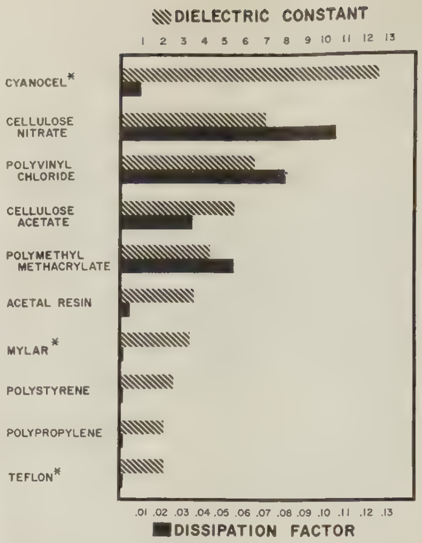


Measured at: 60~110 V.A.C

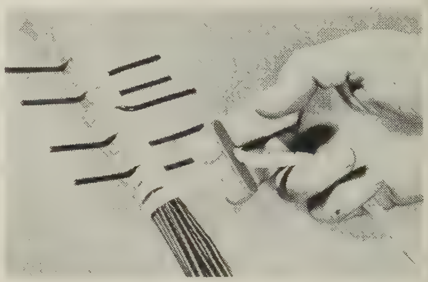
*Trade Mark

cellulose is said to provide a capacitance per unit volume two to six times greater than that of other comparable products. Electroluminescence and microminiature capacitors are two known applications for Cyanocel. Its first commercial use will be in an electroluminescent lamp made by General Electric Co. The electrical properties of this dielectric, however, are expected to be advantageous in other areas. The white, fibrous solid is made by cyanoethylating a highly refined form of cellulose with acrylonitrile. Clear, transparent films as thin as 0.1 mil or as thick as 5 mils or more have been produced. At a frequency of 60 cycles, the 2-mil films have a dielectric constant of 10-15 and a dissipation factor of 0.010-0.025. The films are also said to have good flexibility and physical strength. At 230°C and 50% relative humidity, 2-mil films have a tensile strength of 5380 psi and a Young's modulus of 0.34 x 10^6 psi. Mechanical properties of the films can be changed by incorporating plasticizers. The material also can be molded at high temperature and pressure. Molded articles, under dry conditions, are stated to have a dielectric constant similar to that of the films. American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

Print No. Ins. 103 on Reader Service Card

Spiral Cable Wrappings for Wire Bundles from 1/16" to 4" Diameter

Two new sizes of Panduit spiral cable wrapping for flexible electrical harnesses make a total of three standard sizes now available in clear nylon (type N), clear polyethylene (type F), and white flame-resistant polyethylene (type R). Sizes are 1/8" OD for wire bundles ranging from 1/16" to 1/2" Diam., 1/4" OD for 3/16" to 2" Diam., 1/2" OD for 3/4" to 4" Diam. Spiral wrapping is used in electronic equipment and control panel installations where door hinge cables, "draw-out" loops, and isolated runs are necessary. It reportedly proves ideal wherever a sheath for mechanical protection is required for flexible cables. Because it is re-usable, it is also said to be highly economical for temporary circuits encountered in the control industry and in lab and prototype equipment. Wires may enter or leave the cable at any point. Panduit Corp., Dept. IN-2, 14461 Waverly Ave., Midlothian, Ill.



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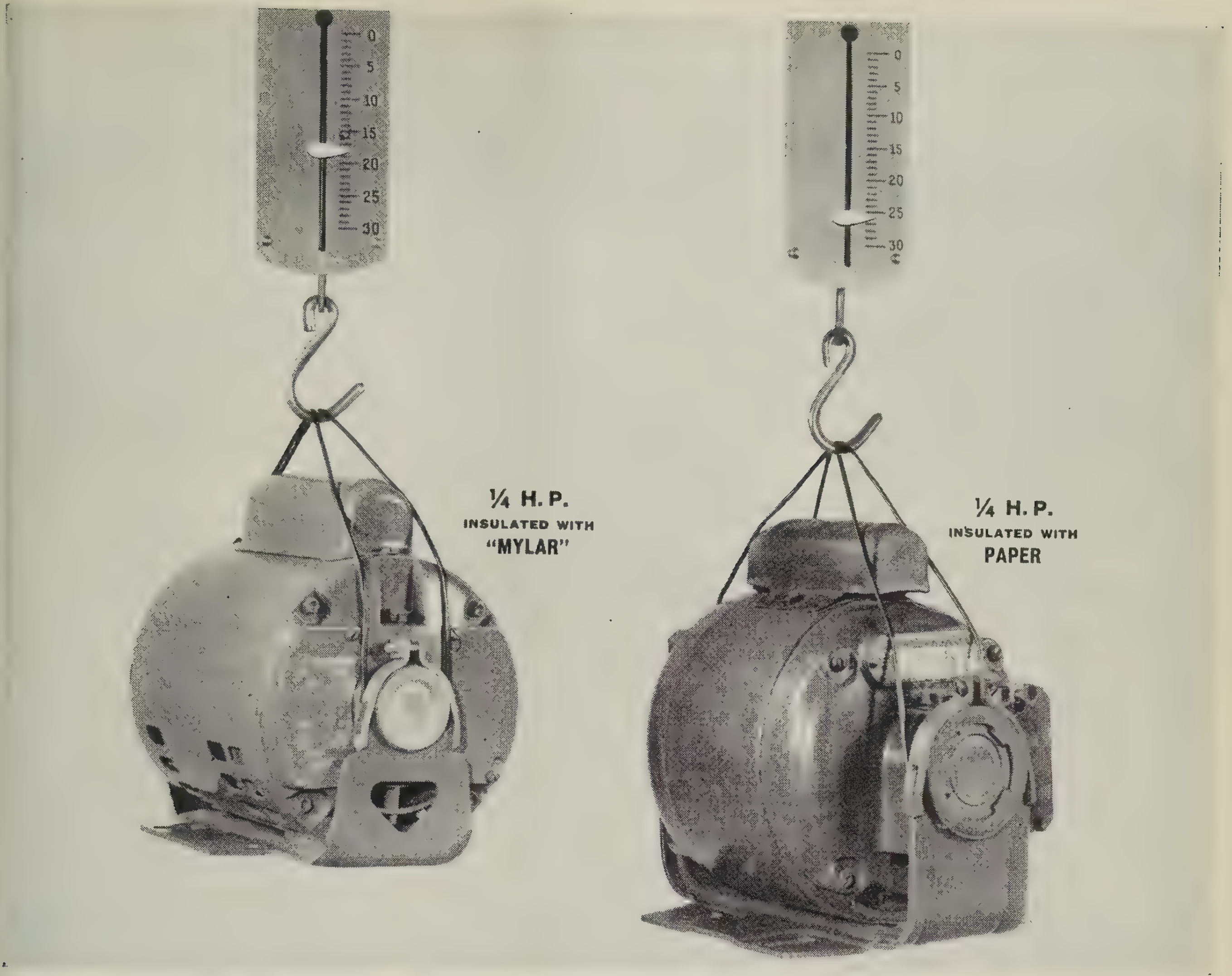
High Temperature, Low Viscosity Epoxies for Electrical Insulation

New "Unox" epoxides 201, 206, and 207 are said to be the only commercial-scale epoxides available with cycloaliphatic structures. Unox epoxide *201* has a low viscosity at room temperature without the use of special solvents or reactive diluents. Because of this low viscosity, voids in castings are filled and bubble formation is reduced. The low viscosity also permits better penetration of both glass fiber laminates and prefilled molds. Applications include electrical and electronic components, encapsulation, laminates, and adhesives. Epoxide *206* serves as a reactive diluent for epoxy resins derived from either Unox epoxides or the bisphenol-A-epichlorhydrin types. A diepoxide, it is said to reduce the viscosity of epoxy resins without degrading their important properties. In the synthesis of epoxy resins, epoxide 206 acts both as a solvent for the solid anhydride and on



Motors insulated with Mylar® are smaller . . . lighter

Motors above have the same rating, but the smaller, lighter one takes advantage of "Mylar"* polyester film for slot and phase insulation.

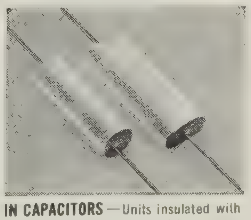
Because of its excellent electrical and physical properties, "Mylar" can be used in thin gauges to help reduce motor size up to 40% and weight up to 33%. The thermal stability of "Mylar" allows motors to run hotter and develop more horsepower from a given frame size.

Insulation of "Mylar" contributes built-in reliability and longer life to appliance motors because its properties do not change over long periods of continuous operation at high temperatures or when exposed to chemicals, solvents and lubricants. And because "Mylar" is unaffected by moisture, current leakage and shock hazard are cut to a minimum. And yet, motors insulated with "Mylar" frequently cost no more than those using other common types of insulation.

Whether you manufacture or buy electrical products, you can get improved performance with Du Pont "Mylar". And, figured on a square-foot basis, "Mylar" will often cost you less than your present material. For full facts on "Mylar", write for free booklet. E. I. du Pont de Nemours & Co. (Inc.), Rm. #14, Film Department, Wilmington 98, Delaware

Tough, thin "Mylar" has this unique combination of properties for superior insulating performance.

- Average 4,000 volts per mil dielectric strength (ASTM D-149). Average power factor of 0.002 at 60 cycles.
- Thermal stability from -60°C. to Class B range.
- Chemical and moisture resistance.
- Resistance to aging, abrasion, tearing and rotting.



IN CAPACITORS—Units insulated with "Mylar" have superior moisture resistance and longer life . . . meet highest reliability standards.

"Mylar" is Du Pont's registered trademark for its brand of polyester film.

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Better Things for Better Living . . . *through Chemistry*

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MYLAR®
POLYESTER FILM

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FLEXLEAD®

SILICONE RUBBER LEAD WIRE

When your project requires a high temperature lead wire with excellent electricals, corona resistance, flexibility, oil and weather resistance, and rated for continuous use at 200°C, try Markel FLEXLEAD Silicone Rubber Insulated Lead Wire. Silicone Rubber is precision-extruded over stranded conductors of silver-plated copper wire to make FLEXLEAD SR, newest product in the *Line of Excellence*. Ask for prices and data.

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heating with a catalyst reacts to form tough plastics that have high resistances to heat. Epoxide *207* forms epoxy plastics that reportedly have excellent high-temperature physical and electrical properties. Its low combining weight provides added savings when used to cross-link or modify low cost resins and polymers. Epoxide 207 can be converted readily to a "B" stage resin in either a solvent or dry powder form, having a shelf life of more than six months. These stable "B" stage resins are suited for impregnating glass fibers. Other applications include molding, fluidized bed coating, and high temperature encapsulation and tooling. The product also offers a possible starting point for the manufacture of plasticizers, protective coatings, and a variety of plastics. Union Carbide Chemicals Co., Div. of Union Carbide Corp., 30 East 42nd St., New York 17.

Print No. Ins. 105 on Reader Service Card

Protective Coating on Fibre Conduit Improves Travel, Weathering Properties

An improved fibre conduit, which reportedly has better weathering resistance and travels and joins better, is expected to broaden the use of fibre conduit as underground raceways for electric cables. The new conduit, "Klean-Kote," has a tough, non-brittle protective coating designed to provide clean and safe handling in transit, storage, or installation. The conduit is also said to be immune to electrolytic action and to resist the corrosive action of acids or alkalies in soils as well as salt water, sewer gases, oils, and greases. Orangeburg Manufacturing Co., Div. of the Flintkote Co., 30 Rockefeller Plaza, New York 20, N. Y.

Print No. Ins. 106 on Reader Service Card

Metal-Filled Silicone for Radiation Shielding, Electrical, Other Uses

A new family of silicone materials is composed of a high percentage of heavy metal particles very finely divided and uniformly dispersed in silicone rubber. Designated "COHR-lastic" HG, the materials reportedly possess the familiar properties of silicone rubber. Properties claimed are: temperature range of —85 to +500°F (—65 to +260°C); extremely good resistance to weather, ozone, and ultraviolet light; unusually uniform shielding against X rays or other high energy radiation; good electrical resistance properties (10^{17} ohm-cm); high specific gravity; resilience and flexibility. Because of the unusual combination of metal and silicone rubber, it is suggested for possible use as a shielding material against high energy radiation or as an acoustic damping material. COHR-lastic HG can be processed in the same manner as normal rubber compounds including molding, extrusion, calendering, and coating on fabric. A preliminary information sheet outlining physical properties may be obtained by letterhead request. The Connecticut Hard Rubber Co., Dept. 5137, 407 East St., New Haven, Conn.

Fibrous Potassium Titanate for Insulating and Other Uses to 1204° C

Fibrous potassium titanate, a new crystalline fiber material for high temperature (to 1204°C) applications, is trademarked "Tipersul." The small, white crystalline fibers are available in lumps and loose fibers, as well as blocks, sheets, and paper forms made by standard felting techniques. Curved or odd shapes are also available. Low heat conductivity, great ability to scatter infrared radiation, low density, and other properties are said to make the material useful for electrical insulation, as well as for thermal, acoustical, and filtration applications. Another significant use for the material is in ablative insulation. Tipersul also may be added to "Teflon" fluorocarbon resins to increase dimensional stability. E. I. du Pont de Nemours & Co., Pigments Dept., Wilmington 99, Del.

Print No. Ins. 107 on Reader Service Card

Tapes Protect Electric Cables From Corrosion and Arcing

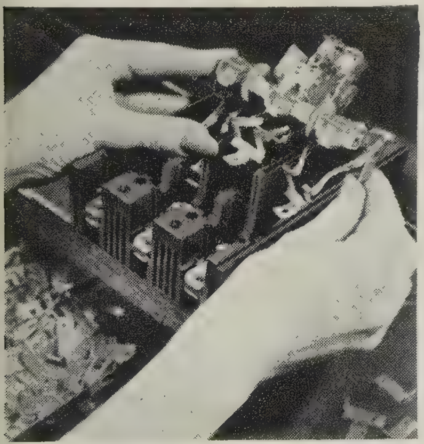
A new two-step system that protects electric cables from corrosion and arcing utilizes "No-Ox-Id" wrap and "No-Ox-Idized" asbestos tape No. 100. The pressure-sensitive No-Ox-Id wrap reportedly combines the effectiveness of a brushed-on corrosion inhibitor with the easy-to-apply features of a roll of pressure-sensitive flexible tape. It is particularly convenient for

Important facts to know about Laminated Plastics

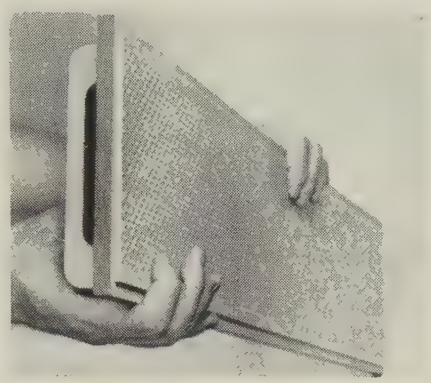
LAMINATED PLASTICS *What they are, where they can be used*

Taylor laminated plastics, also known as reinforced plastics, are thermosetting-type materials formed by impregnating paper, cotton cloth, asbestos, glass cloth, nylon or other base materials with synthetic resins and fusing them into sheets, rods, tubes and special shapes under heat and pressure. These materials exhibit a valuable combination of characteristics, including high electrical insulation resistance, structural strength, strength-to-weight ratio, and resistance to chemical reaction; also adaptability to fabricating operations.

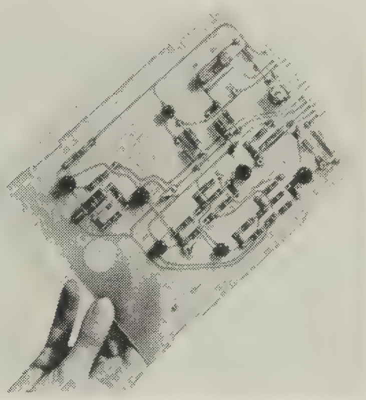
Types of laminated plastics made by Taylor There are four basic types of Taylor laminated plastics commonly specified and used throughout industry today. They are as follows:



Phenolic Laminates. Paper, cotton fabric or mat, asbestos, glass cloth or nylon bases impregnated with phenol formaldehyde resins. These provide strength and rigidity, dimensional stability, resistance to heat, chemical resistance, and good dielectric characteristics. Some Taylor grades are excellent basic materials for gears, cams, pinions, bearings and other mechanical applications. Others are widely used in terminal boards, switchgear, circuit breakers, switches, electrical appliances and motors. Also in radios, television equipment and other electronic devices; and in missiles as nose cones, exhaust nozzles, and combustion chamber liners.

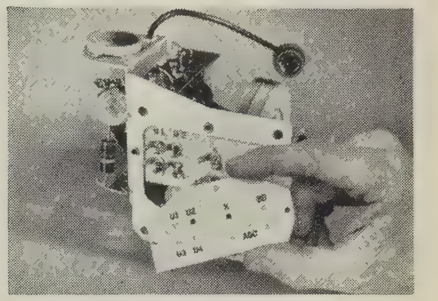


Melamine Laminates. Glass cloth or cotton fabric impregnated with melamine formaldehyde resin. Taylor melamine laminates have superior mechanical strength and are especially desirable for their arc-resistant qualities. Good flame and heat resistance, good resistance to the corrosive effects of alkalis and most other common solvents, besides other favorable characteristics. Typical applications include arc barriers, switchboard panels, and circuit-breaker parts in electrical installations.



Silicone Laminates. Continuous-filament woven glass fabric impregnated with a silicone resin. These laminates combine high heat resistance (up to 500°F. continuous) with excellent electrical and mechanical properties. They are primarily used in high-temperature electrical applications and high-frequency radio equipment.

Epoxy Laminates. Continuous-filament woven glass fabric or paper impregnated with epoxy resin. Glass-fabric grades are designed for use in applications requiring high humidity-resistance, good chemical resistance, and strength retention at elevated temperatures. Paper grades are used under high-humidity conditions where resistance to acids and alkalis is required. Both grades are characterized by good dielectric strength, low dielectric losses, and high insulation resistance even following severe humidity conditions.



• • •

Recent technical advances in the bonding of various metallic and nonmetallic materials to laminated plastics have opened up new design opportunities. It is now possible to bond virtually any compatible material with a laminated plastic to form a composite which combines the advantages of both. One of the first composite materials was a copper-clad laminate used for printed circuits. More recent composite laminates, usually manufactured to customer specification, include the following: Taylorite® vulcanized fibre-clad, rubber-clad, asbestos-clad, aluminum-clad, beryllium-copper-clad, stainless-steel-clad, magnesium-clad, and silver- and gold-clad. Any one of these materials can be sandwiched between sheets of laminates, too, and can be molded to fit specific requirements.

Send for complete information about any or all of these Taylor laminates. And remember Taylor's new selection guide will simplify your problems in choosing the right laminate for your specific application. Taylor Fibre Co., Norristown 51, Pa.

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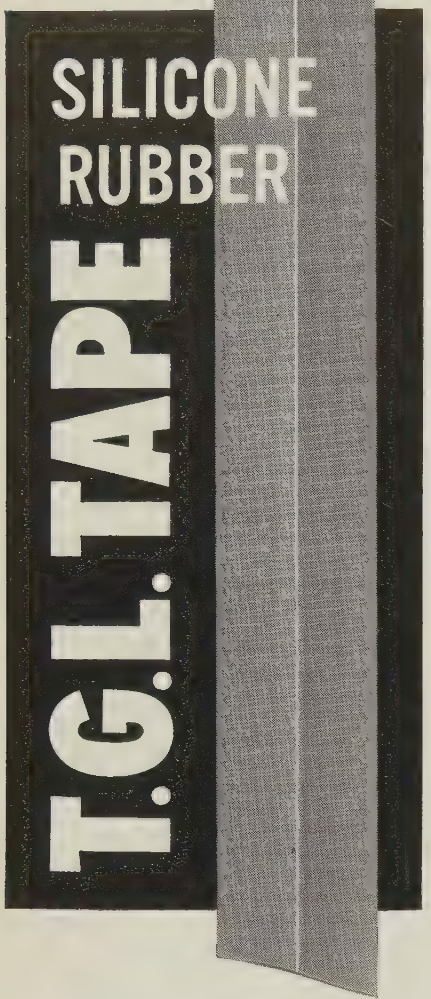

*T*o satisfy the requirements for a self-adhering wrapping tape with all the well-known properties of silicone rubber, Markel has added to the *Line of Excellence* FLEXITE T.G.L. Silicone Rubber Triangular Guide Line Tape. The guide line cuts taping time and insures perfect lapping of the permanently resilient tape to produce void-free insulation with excellent electricals, and resistance to corona, oils, and weathering. Ask for samples.

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1 SOURCE *for* EXCELLENCE *in*
Insulating Tubings, Sleevings, and Lead Wire
NORRISTOWN, PENNSYLVANIA
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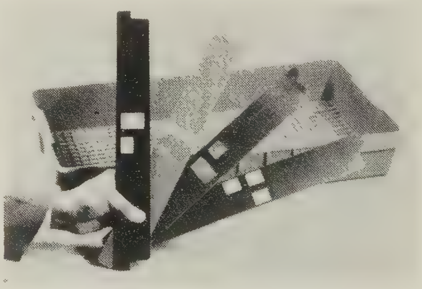
application through narrow openings. The wrap is applied to lead sheathed cable. A ½″ lap is allowed to eliminate voids and protect all cable area against corrosion. After the wrap has been applied, a spiral half-lap application of No-Ox-Idized asbestos tape No. 100 is put on to provide arc-proofing protection. The asbestos tape also can be used alone for arc-proofing protection of neoprene or vinyl-coated cable. Distributor Sales Div., Dearborn Chemical Co., Merchandise Mart Plaza, Chicago 54.

Print No. Ins. 108 on Reader Service Card

Metal-Laminated Plastics Where Intricate Printed Circuits Not Needed

Metal-composite laminated plastics for applications requiring intermittent electrical contact have been developed for use where the more intricate, close-tolerance printed circuits are not required. Typical of possible applications for metal-composite laminates is their use as "tray code readers" in the new automated equipment being installed by the United States Post Office. Attached to the sides of mail-bearing trays, the coded readers signal electrically-activated mechanisms when to shunt the tray to a branch conveyor for a given geographical area. The metal-composite laminates have been supplied with the metal inserted in windows which are cut in the top layers of the laminate, with the metal pressed flush into the laminate, and with a sandwich of metal foil between two layers of laminates which have been cut out at designated locations where electrical contact is desired. Although initial work in this field has been done with copper, cold rolled steel, and stainless steel, it is expected that virtually any metal can be used in making metal-composite laminates. Taylor Fibre Co., Norristown, Pa.



Print No. Ins. 109 on Reader Service Card

Lacquer Enables Applicator to Inspec Printed Circuits Under Black Light

A new fluorescent blue stop-off ink for printed circuits enables the applicator to inspect his work under black light. Designated R 3615 "Nelco," th new silk screening lacquer formulation was developed as an adjunct to R 5018 Nelco blue stop-off ink. A second new formulation, R 6614 Nelco blue stop-off ink is identical to R 5018 except that its viscosity is reduced fo special applications. Chemical Products Corp., East Providence, R. I.

Print No. Ins. 110 on Reader Service Card

Epoxy-Coal Tar Combination For Class A Insulating Uses

A new combination of epoxy resins and coal tar derivatives is said to possess excellent electrical insulating qualities. Reportedly low in density and moderate in cost, "Epocast" H-1338 systems for impregnating and encapsulating are designed for class A insulation of transformers, terminal boards, and miscellaneous electrical components. Dissipation factors and dielectric constant reported at 10^4 cycles and 75°F are .007/3.0 for H-1338/9012-A system and .019/3.80 for H-1338/9816 system. Volume resistivity (ohm-cm) at 750°F is said to be 1.0×10^{15} (H-1338/9012-A) and 1.8×10^{14} (H-1338/9816); 4.8 $\times 10^9$ and 9.9×10^8 at 200°F. Furane Plastics Inc., 4516 Brazil St., Los Angeles 39.

Print No. Ins. 111 on Reader Service Card

Metalized Steatite or High Alumina Tubes for Insulating and Encasing

Metalized ceramic tubes for a wide variety of insulating and encasing applications are available in a comprehensive range of standard sizes. The tubes, available in either steatite or high alumina, have ID's from .105″ to .300″, OD's from .156″ to .395″, and lengths from .250″ to 2.250″. The tubes are metalized with a eutectic solder with a melting point of 183°C. Although the service temperature can be varied depending on the application, most of the high alumina tubes will meet MIL specifications for thermal cycling from —65° to +125°C. Prices range from $70 to $120 per thousand for steatite

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for underground burial cable, with long service life and excellent resistance to moisture

OPALON 1102
OPALON 1103

for primary insulation of urban distribution wire; for jacketing of rural distribution wire, with outstanding weather resistance, excellent low temperature flexibility

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od crush resistance, excel-
t flexibility

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HOW TO PACK A LOT OF INSULATION IN A SMALL SPACE

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has high dielectric strength—400 volts per mil minimum—and close control of caliper and finish allows you to pack a lot of dependable insulation into your layer-wound coils, transformers and other components even though space requirements are tight.

Electronic Glassine is clean, chemically neutral and without holes, spots, conducting particles or tearouts. It also meets the toughest requirements for non-insulating uses, too... mold release in coil insulating processes, mandrel cover for tube winding and protective sheeting during varnishing or grinding.

Electronic Glassine is available in both sheets or rolls; six thicknesses from .00075 to 0.0030 in. Write for samples and the Riegel Electrical Data Folder. **Riegel Paper Corporation, P.O. Box 250, N. Y. 16, N. Y.**

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tubes and $120 to $210 per thousand for high alumina tubes. Bulletin EP-978 available. Centralab, The Electronics Division of Globe-Union Inc., 900 East Keefe Ave., Milwaukee 1, Wis.

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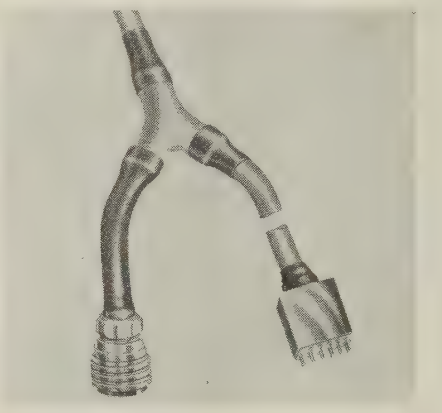
New Irradiated Polyolefin Tubing Heat Shrinks for Tight Insulation

Flame retardant and thermally stable, a new flexible polyolefin tubing designated "Hyshrink" can be slipped easily in its expanded form over terminals, connectors, wire and cable, conduit, and hose. Upon application of heat (275°F), the tubing shrinks in diameter to form a strong mechanical bond. This heating will not affect the flexibility of the irradiated tubing. Longitudinal shrinkage is less than 10%. High dielectric and mechanical strength and tested resistance to most chemicals, including JP4 and 100/300 aviation fuels and hydraulic fluids such as "Skydrol," are claimed. The new tubing also reportedly resists fungus growth, gives off no toxic fumes when heated, shows a weight increase of .01% or less after immersion in water, and remains flexible and strong from temperatures of 67°F to +275°F (19.4°C to +135° C). Within this range, the applied tubing will not melt, harden, flow, run, crack, or blister. The material is also said to demonstrate exceptional resistance to radiation. The new tubing and sleeving material can be used in a wide variety of electrical and electronic applications (for insulating splices, connectors, pigtails, etc., and for identification purposes) and, because of its temperature characteristics, has applications in nuclear ships and installations, space vehicles, and in other commercial and military electronic applications. Dept. EFL Anaconda Wire & Cable Co., 25 Broadway, New York 4.



Print No. Ins. 113 on Reader Service Card

Vinyl Electrical Conduit Saves Up to 60% of Installation Costs

A new line of rigid "Koroseal" vinyl electrical conduit is said to permit savings of up to 60% in installation costs (based on comparison with installation costs of metal or fibre conduit). The new product is recommended for all types of electrical conduit systems and telephone circuits and especially where unusual corrosive conditions exist. Test installations reportedly have successfully overcome corrosion problems met in bridge, causeway, and dam construction, and in underground raceways for television and electronic circuits. Koroseal conduit weighs only ⅛ to ¼ as much as metal conduit and comes in 20 ft. lengths. It is claimed that the conduit is flame-retardant, non-magnetic, and will not spark when struck, can be cut with ordinary tools, can be bent easily after heating, can be threaded with the same tools used for metal conduit, and can be joined by solvent welding which provides a joint stronger than the conduit itself. B. F. Goodrich Industrial Products Co., a division of the B. F. Goodrich Co., Akron, Ohio.

Print No. Ins. 114 on Reader Service Card

Thinner for RTV Silicone Rubber

A new fluid-like silicone additive has been developed for adjusting and controlling the viscosity of RTV-type silicone rubbers. Named "Silastic" RTV thinner, the new material is designed to increase the flowability of uncured RTV silicone rubbers without affecting their performance. Most RTV silicone rubbers are normally supplied as solventless, pourable fluids that vulcanize at room temperature. Major uses include mold-making, forming prototype parts, and a variety of caulking, sealing, potting, and encapsulating applications. Presently available RTV rubbers are satisfactory for most applications; however, lower consistency materials would greatly facilitate ease of handling in special cases. The new thinner, a nonsolvent system, reportedly can reduce

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NEW! Fully-cured flexible epoxy resin, reinforced with glass, in pressure-sensitive tape form.

A new product of 3M Research!

"SCOTCH" Brand Electrical Tape No. X-1099 has all the electric strength of fully-cured epoxy resin, with all the mechanical strength of glass cloth, combined in convenient pressure-sensitive tape form for Class F (150° C.) applications. Adhesive is non-corrosive and thermosetting. Backing is fully compatible with epoxy resin insulating systems — cleavage planes are eliminated. Write for complete information: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. EAE-90.

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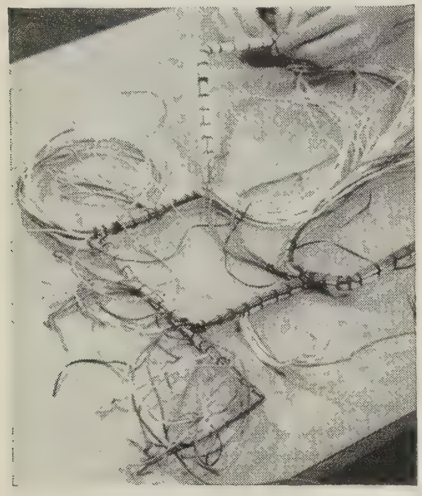

It's no accident that Gudelace is the best lacing tape you can buy. Excellence is *engineered* into Gudelace. A sturdy nylon mesh is meticulously combined with the optimum amount of special microcrystalline wax. Careful selection of raw materials and superior methods of combining them give Gudelace outstanding strength, toughness, and stability. Gudelace is the original *flat* lacing tape which distributes stress evenly over a wide area. It is engineered to stay flat; it will not stretch out of shape when pulled. Gudelace's nonskid surface prevents slipping, eliminating the too-tight pull that causes strangulation and cold flow. Durability and dependability make Gudelace your most economic buy—with no cut insulation, fingers, or feelings.

Write for Data Book with specifications on Gudelace and Gudebrod's complete line of braided lacing tapes and dial cords—Temp-Lace, Stur-D-Lace, and Gude-Glass.

GUDEBROD
BROS. SILK CO., INC.

Electronic Division
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Executive Offices
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the viscosity of Silastic RTV rubber by as much as 75% of its original consistency without significant changes in the physical properties of the fully vulcanized rubber. Dow Corning Corp., Midland, Mich.

Print No. Ins. 115 on Reader Service Card

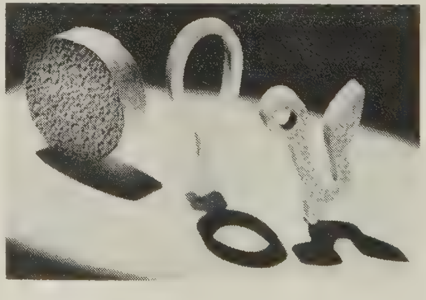
Copper-Clad Laminates With Increased Peel Strength

A new adhesive used on all "Textolite" copper-clad laminates is stated to significantly improve strength and printed circuit reliability under high temperature conditions. The adhesive reportedly has increased peel strength (the measure of force required to separate the copper from the laminate) by more than 2 lbs on all grades of copper-clad laminates. The new bonding material is also said to offer greater resistance to adhesive deterioration under prolonged high temperatures, a reliability factor of particular importance to many missile and computer printed circuit applications. General Electric Co., Coshocton, Ohio.

Print No. Ins. 116 on Reader Service Card

Silicone Sponge Shapes With High Heat Dielectric Qualities

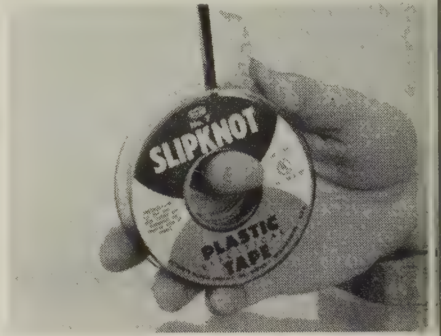
New extruded and calendered complex silicone sponge shapes are said to enable manufacturers in the aircraft, electronics, appliance, and other industries to employ superior and more versatile sponge parts while realizing important savings in production costs. Extruded silicone sponge cross-sections are available in long lengths, continuous lengths, coils, and rolls. Sheets of silicone sponge measuring up to 36″ in width can be produced by the calendering method. Calendered sheets can be combined with "Orlon," "Dacron," nylon, fiber glass and other heat resisting fabrics. The silicone sponge is also claimed to provide unparalleled resistance to aging, sunlight, ozone, oils and chemicals, plus excellent dielectric qualities at extremely high temperatures. Samples and data available. The Stalwart Rubber Co., Northfield Rd., Bedford, Ohio.



Print No. Ins. 117 on Reader Service Card

New Package Protects, Dispenses, And Cuts Electrical Tape

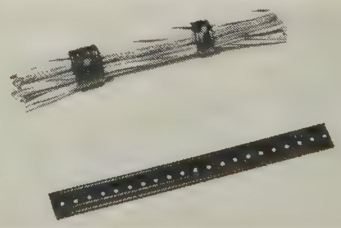
A new tape dispenser and case, called the "Flip 'N' Cut," is designed to hold the standard 66-ft roll of "Slipknot" No. 7 plastic electrical tape. It reportedly is the only package which stores, protects, dispenses, and cuts the tape while in use. The package is said to be easy to use, handy, to carry, and sturdy enough to withstand the rigors of the toolbox as well as the job. It is made of high-impact rigid plastic. Design patent is pending. The dispenser package is free with each 66-ft roll of Slipknot No. 7. Plymouth Rubber Co., Canton, Mass.



Print No. Ins. 118 on Reader Service Card

New Wire and Cable Insulation Strapping for Securing and Harnessing

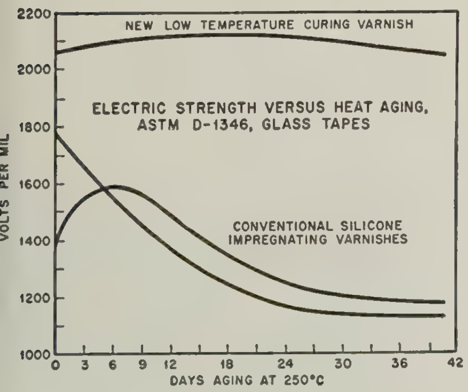
A new wire and cable tying system called "Insuloid" strapping consists of two components, a highgrade PVC plastic belt with conveniently spaced mounting holes and a stud-like insert resembling the old collar button. Installers simply wrap the strap around the wire or cable run to be held and snap-in a stud. This tying system reportedly can be used to secure or group all types of unsupported wire and cable in any diameter or form without waste. Strapping is available in 75 ft coils and two widths. The 5/16″ width costs $2.25 per coil and



New G-E silicone varnish helps make QHT transformers up to 50% smaller, 35% lighter

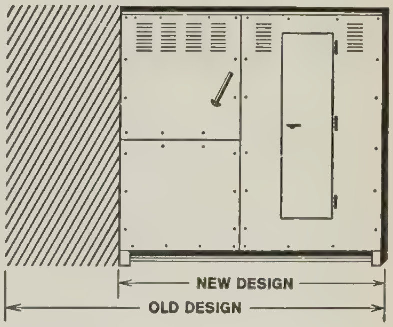
SR-220 HAS SUPERIOR THERMAL STABILITY, CURES AT 150°C

New SR-220 silicone varnish with outstanding high temperature resistance and low cure temperatures offers new opportunities to improve equipment designs. General Electric's Specialty Transformer Dept. took full advantage of this design flexibility to reduce size, weight *and* noise level of new QHT dry-type transformers. SR-220 cures in same ovens used for organic varnishes, has excellent shelf life and tank stability. Whether the design objective is more compact equipment, increased life, or extra overload capacity, SR-220 will meet the task.



Thermal stability superior to conventional silicone varnishes combined with low-temperature (150°C) cure increases application range of silicone varnish. SR-220 offers improvements for all classes of insulation — without requiring investment in high-temperature ovens.

New G-E Integral Distribution Centers also benefit from design flexibility afforded by silicone insulation: new compact design reduces floor space requirements 30%. Unit combines QHT transformer with all equipment for switching and protection of incoming line and outgoing feeders.



Write to Section M929 for free data: "Silicones for Electrical Insulation."

GENERAL ELECTRIC

Silicone Products Department, Waterford, New York

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the 1/2″ width, $3.75 per coil. Studs are $5.00 per thousand. Electrovert Inc., 122 E. 40th St., New York City.

Print No. Ins. 119 on Reader Service Card

Transparent Vinyl Tubing Shrinks Under Heat to Fit Component Shapes

A vinyl tubing which shrinks under heat to provide a tight covering for either symmetrical or gently contoured shapes in now available as a clear, fully transparent tubing. It previously has been available as a standard item only in black. Designated "ScotchTite" brand heat reactive tubing No. 3025, it will also be available in special colors. The pre-expanded tubing reportedly shrinks under heat to its normal dimensions in 4 to 8 min at 300°F (149°C). Available for application on objects ranging in size from 3/64″ to 5″ in OD, the tubing is being used for covering harness cables, condensers, coils, ground straps, high voltage leads, bus bars, and other items where a tight, abrasion and chemical resistant electrical insulating cover is required. The UL recognized electrical insulating tubing is furnished in continuous lengths. An electrical strength of 1000 v in .016″ wall thickness, a tensile strength of 3200 psi, ultimate elongation of 300%, and a cold brittle point of —20°C are reported. Irvington Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 120 on Reader Service Card

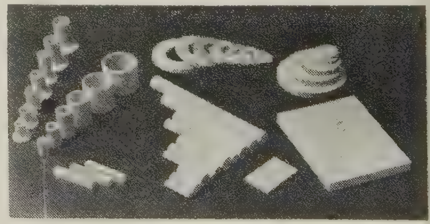
Epoxy Plasticizers for Vinyl and Other Insulating Formulations

Three new Flexol epoxy plasticizers for use in vinyl and other insulating formulations are now available in commercial quantities. *EPO* is characterized by its high oxirane oxygen and low iodine number, giving vinyl formulations such as clear sheeting long-term compatability, stabilizing action, and resistance to both color development and rancidity. *JPO* has lower oxirane oxygen and higher iodine number. Both of these high molecular weight epoxy products are said to be effective, low cost stabilizers and plasticizers. Their synergistic action with many of the metallic stabilizers reportedly increases resistance of vinyls to heat and light degradation. As plasticizers and stabilizers for vinyl chloride polymers, both EPO and JPO have low volatility and excellent resistance to extraction by oil and water. Electrical insulations, calendered film and sheeting, coated fabrics, gaskets, foam, and molded articles are among the many products that may benefit from the use of EPO and JPO. EPO and JPO are also stated to be effective acid-accepting stabilizers for chlorinated solvents and rubber as well as plasticizers for nitrocellulose coatings and synthetic rubbers. As reactive epoxides, EPO and JPO form polyester-type resins for use in coatings, encapsulations, and adhesives. *EP-8*, a 2-ethylhexyl epoxy tallate, is designed for use in vinyl chloride resins where flexibility as well as heat and light stability are desirable at low temperatures. It may be used as a replacement for the more expensive azelate, adipate, and sebacate plasticizers presently being used for low-temperature applications. It is also an excellent epoxy stabilizer substitute for the commonly used epoxidized soybean oils. Because of its low specific gravity, EP-8 has a low volume cost. The low viscosity and solvating power characteristics give plastisols low viscosity and excellent viscosity stability. Union Carbide Chemicals Co., Div. of Union Carbide Corp., 30 East 42nd St., New York 17.

Print No. Ins. 121 on Reader Service Card

Stock Ceramic Parts for 2100°F

A new line of ceramic parts including insulating bushings, washers, rods, discs, plates, and v-blocks is designed for use at temperatures to 2100°F (1149°C). The material is also said to have excellent thermal shock resistance. The parts can be modified for use in both development and production work by grinding with sili-



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Wire stripping problems fade away with a Wassco Glo-Melt wire stripper. This new tool is a cool, light, highly flexible hand piece with a single, heavy duty Nichrome cutting element for long life. It can be used for on the job applications or for bench work with optional foot control. The Wassco Glo-Melt wire stripper gives you a cleaner, faster job . . . is perfect for hard-to-get-at places . . . strips insulation including Telflon, Nylon and fiberglass up to No. 8 insulated wire with a simple *twist of the wrist.* No sharpening or adjusting,—just plug in and you are ready instantly to do a perfect stripping job with speed and ease. Inquire about our 10 day free trial.

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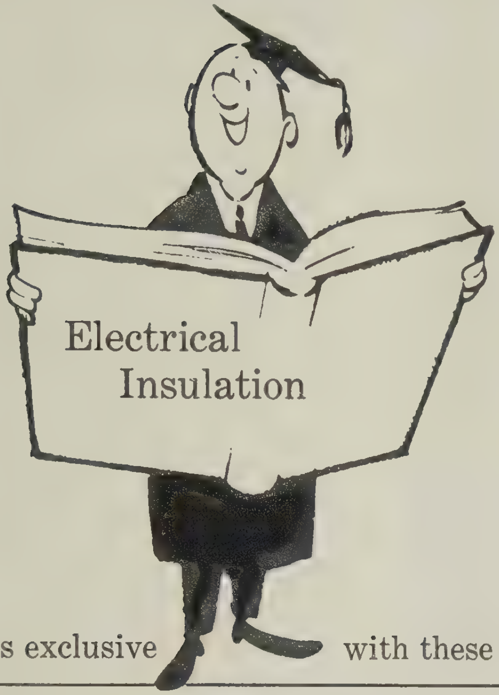

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High tensile strength

High cloth count insures complete and uniform glass coverage over area of fabric.

Highest quality glass tape made with "D" fiber yarns

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2040 West Wisconsin Avenue

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NEW YORK, NEW YORK
MITCHELL RAND MFG. CORP.
Insulation Division, 51 Murray St.

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Plants located at:
Anderson, S. C.
Easley, S. C.
Greenville, S. C.

Print Ins. 57 on Reader Service Card

con carbide wheels or ultra-sonic hole drilling. Duramic Products Inc., 426 Commercial Ave., Palisades Park, N.J.

Print No. Ins. 122 on Reader Service Card

Thixotropic Epoxy Dipping Compound

Thixotropic epoxy coating compound "Isochemgel" 104 is an improved version of the older Isochemgel 103. With a new flexibilizing system, it is believed to be more stable and more resistant to moisture and to high heat. In addition to excellent physical and electrical properties, it is said to possess a high degree of thixotropy which insures smooth, sag-free, non-drip coatings even on vertical surfaces. The material is suited for use as a dipping compound for coating small coils, motor fields, transformers, chokes, resistors, capacitors, and similar items. The cured coating reportedly adheres tenaciously to lead wires and provides a lustrous and enamel-like scratch resistant surface that will not crack or craze even on severe thermal shock. The cured coating is also said to have a volume resistivity (ohm-cm) at 25°C of 3×10^{12} and a dielectric strength at 25°C of 390 vpm on 20-mil film. Isochem Resins Co., 221 Oak St., Providence 9, R.I.

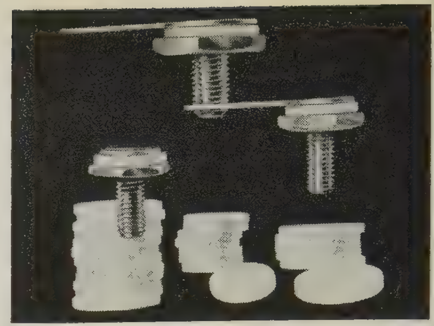
Print No. Ins. 123 on Reader Service Card

High Temperature Elastomer

A new "Viton" compound, based on DuPont's Viton B polymer, is approved under MIL Spec 25897C covering high temperature, oil, and fuel resistant elastomers. Designated as Haveg grade 16075, it was formulated to provide superior compression set resistance under severe operating conditions. Dielectric strength is reported to be 400 vpm. Excellent resistance to high temperature, aromatic fuels, and hydraulic fluids coupled with superior compression set, and resistance to ozone, oxidation, weathering, flame, and corrosive acids, reportedly make 16075 a strong candidate for applications involving abnormally severe service. Haveg Industries Inc., Taunton Div., 336 Weir St., Taunton, Mass.

Print No. Ins. 124 on Reader Service Card

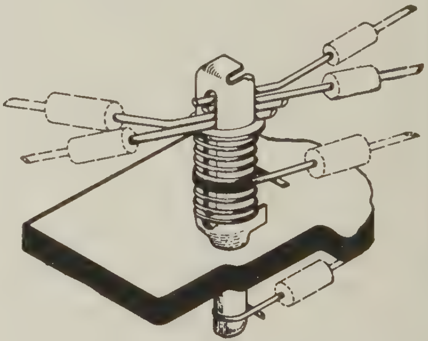
Ceramic Diode Base Assemblies With Improved Thermal Conductivity



A new CFI body series 696 ceramic for use in a variety of insulated diode base assemblies possesses a minimum alumina content of 97%. In addition, the basically finer grain of this new ceramic formulation reportedly results in improved thermal conductivity in insulated base assemblies. Because of its higher tensile strength, series 696 ceramic is said to contribute to strip test values that consistently register 50% greater than product specifications require. CFI Corp., Cottage Place, Mineola, N.Y.

Print No. Ins. 125 on Reader Service Card

Reliable Solderless Terminal for Experimental Circuitry

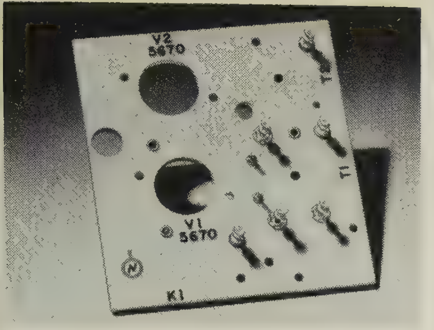


A new terminal designed especially for experimental circuitry, the T-30 solderless "Springclip" holds up to six leads without soldering and reportedly may be used over and over. No staking is required, and Springclips fit any round 0.093″ hole. Contact resistance between leads and the terminal is said to be less than 0.003 ohms due to silver plating on the terminal and the springclip holding action. Vector Electronic Co., 1100 Flower St., Glendale, Cal.

Print No. Ins. 126 on Reader Service Card

Lower Cost, Custom Terminal Boards

A new method of manufacturing custom designed terminal boards is said to greatly increase production speed and product quality—yet lower unit costs, even on small production runs. Automatically machining laminated boards and terminal strips re-



portedly permits greater uniformity and rigid manufacturing controls to meet MIL-Q-9858, MIL-Q-5923C, and MIL-STD-105 procedures. Terminal boards may be machined from silicone, melamine, epoxy, or other laminates. Terminals may also be of specialized types. Special Products Div., National Connector Corp., 311 Fifth Ave. N., Minneapolis 1, Minn.

Print No. Ins. 127 on Reader Service Card

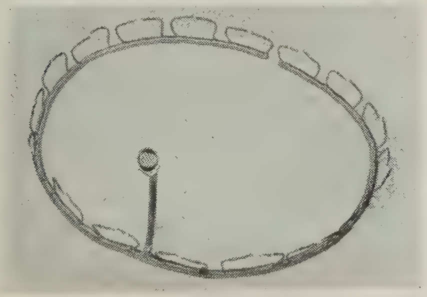
Solderable Silver Plated Steel Strands For Strengthening Stranded Conductors

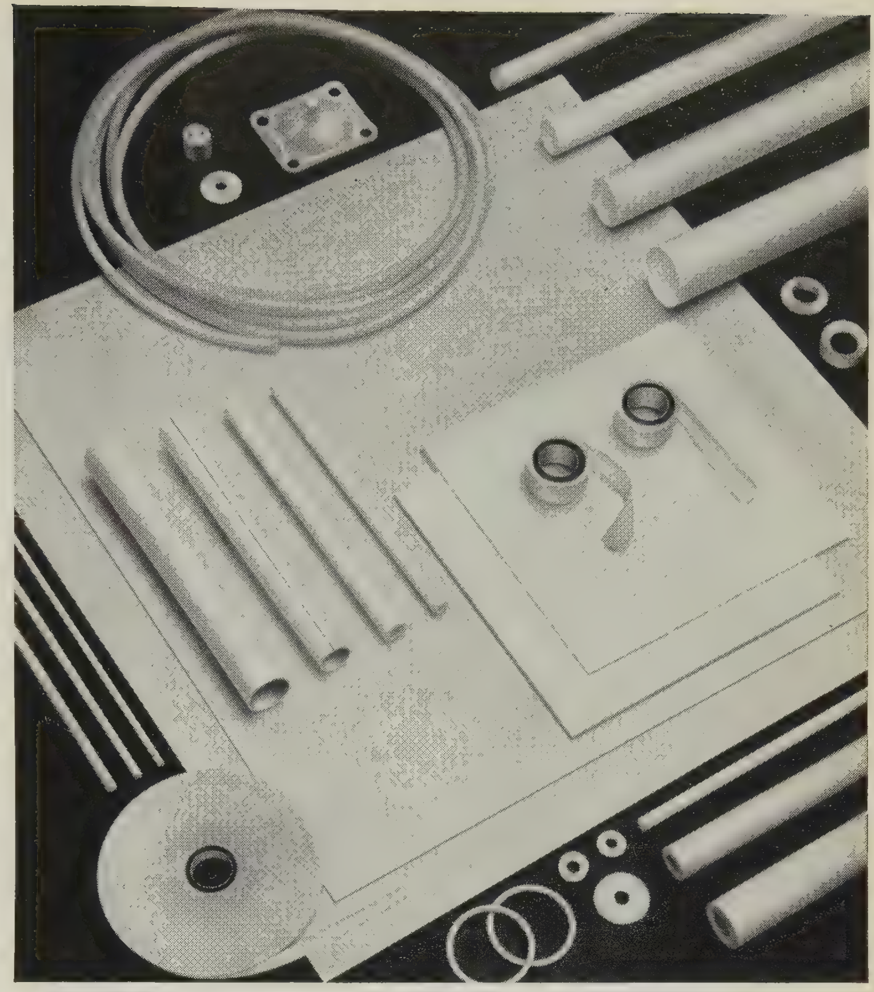
Silver plated stainless steel strands have been developed for use as strength members in stranded conductors. Because of high tensile strength, stainless steel strands are desirable as reinforcing members in stranded conductors. However, the non-solderability of stainless steel has been a problem to the electronics and related industries. A new process for silver plating the stainless steel strands is said to enable them to be soldered with an adherence equal to plated copper strands. Hudson Wire Co., Ossining Div., Ossining, N.Y.

Print No. Ins. 128 on Reader Service Card

New Harness and Grouping Techniques For High Temperatures

The illustrated harness assembly is engineered especially to meet the high temperature demands of modern thermocouple thermometry. Grouping the wire leads of individual thermocouples into a stainless steel covered, flexible, yet compact harness unit is said to make possible such advantages





Now you can do even more with TEFLON – made bondable by R/M

Time was, you'd often rule out "Teflon"* where it was sorely needed, simply because you couldn't make anything adhere to it.

But not now. R/M has perfected a process that makes "Teflon" easily bondable to other materials and to itself with commercial adhesives. In designing with "Teflon" you don't have to use elaborate and costly fastening methods.

R/M can supply "Teflon" sheets and tape with bondable surfaces where you specify them. Thus you can use the unique combination of electrical, chemical and heat-resistant properties of "Teflon" without worrying about how to make it stay put. In fact, you can take advantage of bondability and non-bondability in the same R/M "Teflon" part.

A lot is happening in "Teflon" daily. To keep up with it, talk "Teflon" with the R/M man—learn of R/M's *complete "Teflon" service* that can help you cut product costs without cutting corners. Call one of the offices listed below or write Plastic Products Division, Raybestos-Manhattan, Inc., Manheim, Pa.

*Du Pont trademark for its TFE-fluorocarbon resin

R/M

PLASTIC PRODUCTS DIVISION
RAYBESTOS-MANHATTAN, INC.
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New from CFI
ceramics for industry

High Alumina Ceramic Diode Base Assemblies

New CFI Series 696 ceramic built into diode base assemblies—another production breakthrough from CFI's fully integrated ceramic service to industry.

The 696 Series features 97 per cent minimum Alumina content, a basically finer grain structure for improved thermal conductivity in diode base assemblies and higher tensile strength that gives strip test values consistently 50 per cent greater than product specifications call for.

These diode base assemblies are available from CFI in the 696 Body in production quantities or as sample lots for engineering and quality evaluation. **Use coupon below for free CFI data.**

Tunnel Diode Envelopes
CFI is currently making ceramic tunnel diode envelope composites for manufacturers on a company classified basis. We would be glad to work on your tunnel diode specifications and requirements with your engineers.

CFI *An Integrated Ceramics Service*

CFI Corporation
Department I, Cottage Place
Mineola, New York—Pioneer 6-0571

Gentlemen: Please send me, without obligation, the following literature on CFI ceramics:
☐ "Custom Ceramic Parts for Industry" Brochure
☐ Semiconductor Ceramics Spec Sheet
☐ Have technical representative contact me.

Name________
Title________
Company________
City______ Zone______ State______

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as reduced installation and removal time, easier storage, less wear and tear through handling, extended performance life, improved circuit reliability, faster, more certain circuit repair, and function is not affected by failure of individual T/C. Special high temperature clips simplify high temperature harness orientation and installation. Harnesses are available in a wide range of sizes and materials and for applications as high as 1600°F (871°C). Bulletin 202 available. Harco Laboratories Inc., 77 Olive St., New Haven, Conn.

Print No. Ins. 129 on Reader Service Card

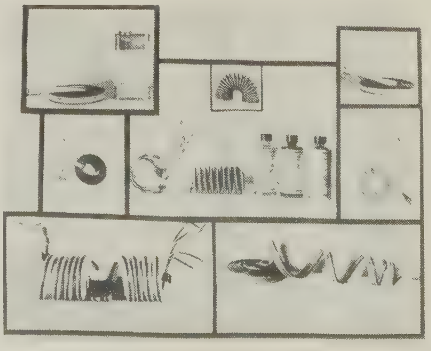
Insulated Hook-Up Wire for Continuous Service at 1000°F

A new hook-up wire has an inorganic insulation that reportedly offers good abrasion resistance; can be handled without special precautions; does not become carbonaceous, conducting, or embrittled at elevated temperatures; and offers continuous service at 1000°F and intermittent service up to 1800°F (depending on application). The braid and fibrous insullation is claimed to withstand 2000°F without decomposing or melting. Called BB-1000, typical characteristics of a size #18 AWG are said to include a dielectric strength of 9000 v (3500 v after 5 hrs at 1600°F) and weight of 17 lbs/1000 ft. Each conductor is stranded stainless steel clad copper with a wall of "Refrasil" fused quartz. It is also stated that high intensity nuclear radiation does not adversely affect the cable. Birnbach Radio Co. Inc., 145 Hudson St., New York 13.

Print No. Ins. 130 on Reader Service Card

Trial Kits of Wiring Specialties

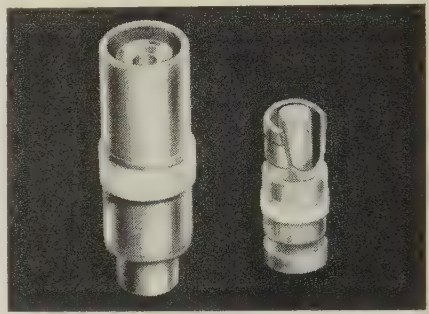
New wiring specialties trial kit for sale contains the latest types of cable, including "Spectra-Flex" retractable cable. Every item is said to be practical, usable, and useful. Spectra-Strip Wire & Cable Corp., P. O. Box 415, Garden Grove, Cal.



Print No. Ins. 131 on Reader Service Card

Ceramic-Metal Seals for Coaxial Leadthrough Terminals

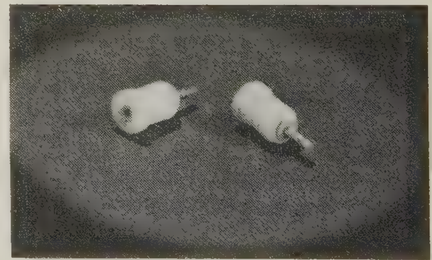
A new ceramic-metal seal composite is designed for insertion into envelope structures by use of high temperature braze material. The primary ceramic-metal seal with "Stressfloat" construction is said to be relatively isolated from terminal and envelope stresses, permitting the use of large diameter copper leadthroughs and high temperature seal-in procedures. Typical seals have copper studs of 1/8″ and 1/4″ diameters, with over-all composite diameters of 5/16″ and 1/12″. Suggested applications include coaxial high voltage leadthroughs requiring the high conductivity characteristics of a solid copper terminal. Ceramic detail can be modified to meet specific application insulation requirements. Ceramics for Industry Corp., Cottage Place, Mineola, N. Y.



Print No. Ins. 132 on Reader Service Card

Closed Entry "Teflon" Test Jack

A new test jack providing closed entry and a stud terminal, Sealectro "Press-Fit" SKT-35, is designed for use with .032″ diam × .200″ max probe. The closed entry is claimed to assure perfect alignment of the test probe with the beryllium copper contacts. The Teflon body is .148″ diameter for through-chassis installation, with a .172″ diameter dimension above the chassis. Sealectro Corp.,

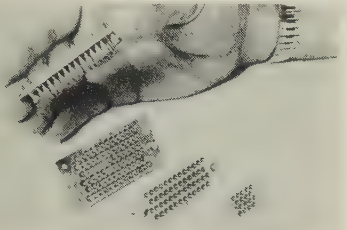


139 Hoyt St., Mamaroneck, N. Y

Print No. Ins. 133 on Reader Service Card

Hermetically Sealed, Polarized Rack and Panel Connectors

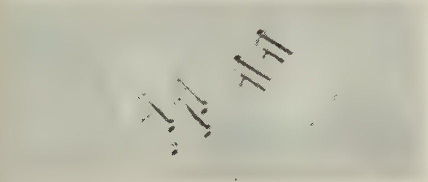
A line of miniature hermetically (glass-to-metal) sealed, rectangular polarized "Recon" connectors is available in layouts from 7 pins through 104 pins for standard commercial sockets. Polarizing hardware is standard or screw lock. Inside pin terminations are either flattened or pierced for wire soldering, or straight for double socket mating. Specially designed production methods and rigid quality control procedures are claimed to assure mass spectrometer tightness, consistently high voltage breakdown, high insulation resistance, and freedom from binding. Hermetic Seal Corp., 43 River Rd., North Arlington, N. J.



Print No. Ins. 134 on Reader Service Card

Four-Pin "Teflon" Transistor Holders

New four-pin transistor holders, designated TC-400T, feature fast and economical chassis insertion and extra-long terminals which reportedly act as a heat sink and permit soldering of transistors in place with greatly reduced danger of damage to the transistor elements. Available in nine EIA colors plus white. Sealectro Corp., 139 Hoyt St., Mamaroneck, N. Y.



Print No. Ins. 135 on Reader Service Card

Tester for Tensile, Compression, Transverse, and Shear Forces

All materials such as metal, plastics, fabrics, wire, etc., can be tested with a new, all-around model M tester. Changes in grips adapt the basic instrument for tests of tensile,

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For quality laminates . . . Mosinee Saturating and Impregnating Papers

- These Mosinee papers give you precision control over quantity and rate of resin absorption.
- Mosinee saturating papers are made to your specifications.
- You'll get the exact penetration rate, degree of saturation, and resin pickup you desire.
- Apparent density as reflected by basis weight and caliper will be precisely as you have ordered.
- Quality will be uniform from roll to roll . . . from carload to carload . . . as long as you order.

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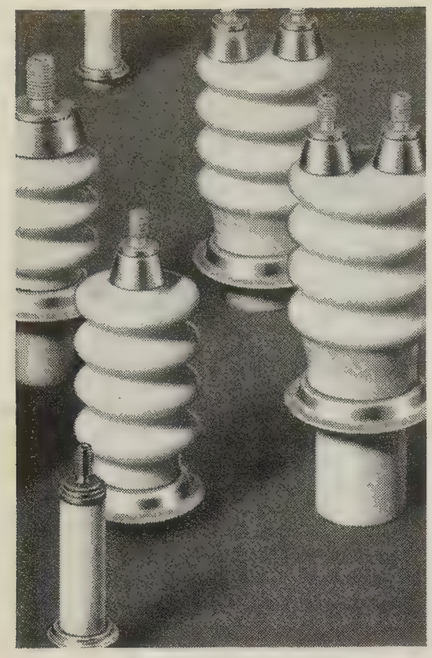

COORS STANDARD TERMINAL INSULATORS

Fast, off-the-shelf delivery... low price

Coors standard terminal insulators are regular stock items, available for immediate shipping. They are manufactured on a regular production basis, resulting in low manufacturing costs—and low prices.

Coors Terminal Insulators give you these important benefits:

1. High dielectric strength. 2. Excellent surface resistivity. 3. Great physical strength. 4. Permanent dimensional stability. 5. Extreme hardness. 6. Resistance to high temperatures. 7. High temperature subsequent brazes. 8. High thermal shock resistance. 9. Vacuum tight metal-ceramic assemblies.

Coors Offers Complete Ceramic Engineering Service.

Need special terminal insulators or metalized assemblies? A Coors Field Engineer is near you to give you ceramic design help. Call him today—or write for complete Technical Data Sheets on Coors Ceramic and facilities.

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East Coast	John J. McManus MA 7-3996—Manhasset, N.Y.
New England	Warren G. McDonald FR 4-0663—Schenectady, N. Y.
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Southwest	William H. Ramsey UN 4-6369—Houston, Texas

Coors
COORS PORCELAIN COMPANY
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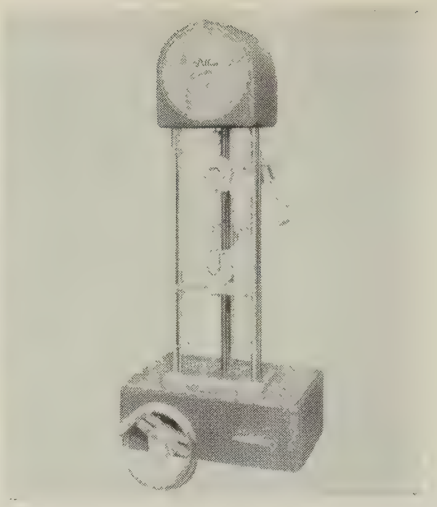
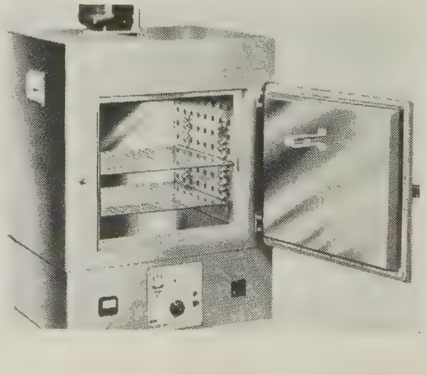


compression, transverse, and shear forces. Operation of the unit is by means of a calibrated pendulum. All testers are guaranteed accurate within ½ of 1% of indicated reading. Five ranges, from 0-10 lbs to 0-300 lbs, are combined on the one 8″ dial. Calibration is available in a choice of ounces, tenths of pounds, or kilos. Permanent stress-strain curves are also possible with an accessory rotating drum recording system. The model M testers are available with a manual handwheel, or motorized and can be converted from manual to motor operation at any time with a motorization kit. They are also supplied with built-in controlled temperature cabinets with working ranges from room temperature to 400°F (204°C). W. C. Dillon & Co., Inc., 14620 Keswick St., Van Nuys, Cal.

Print No. Ins. 136 on Reader Service Card

Miniature Batch Ovens

Bench model miniature batch ovens with a temperature range of —100°F to +500°F (—73.3°C to +260°C) are designed for aging, drying, preheating, baking, and similar procedures in the electronic and other industries. Control and uniformity reported is ±1°C at 260°C and



±½°C at 200°C. Inside dimensi
are 19″W x 18″H x 17½″D. Bu
tin available. Blue M Electric C
138th and Chatham St., Blue Isla
Ill.

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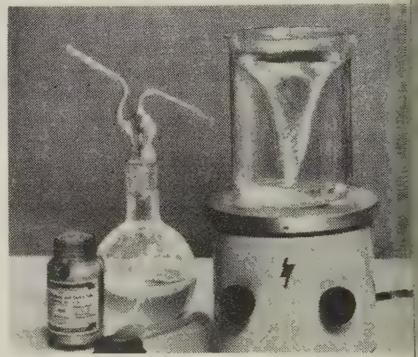
Heating Plate with Magnetic Stirre

A new laboratory appliance co
bines the functions of a stirrer and
heater. The speed of stirring is c
tinuously adjustable while the heati
is adjustable in four steps. The st
ring action is produced by a sma
self-centering insert of a chemical
inert material (glass or "Teflo
shell) which is spun by magnetic i
duction from a rotor in the hot pla
This appliance is especially valua
when the container is not easily



cessible for conventional stirrers (f
example, when the stirring acti
must take place in a vacuum or
closed vessels) or when the stirri
action must be varied from gentle
vigorous. The stirrer is also availab
without the heater. New England Sc
entific Instruments Corp., 238 Mai
St., Cambridge 42, Mass.

Print No. Ins. 138 on Reader Service Card

Electrolytic Condenser Bridge

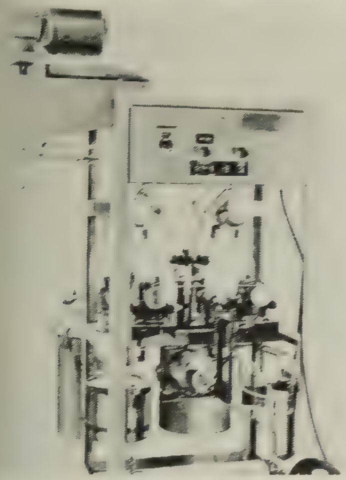
The CB 154-D electrolytic co
denser bridge is designed for t
measurement of capacity, power fa
tor, and leakage current. It is said
be ideally suited for the measureme
of low voltage aluminum foil a
tantalum electrolytic capacitors. T
instrument works off a 110/220 v
cycle line, is self-contained, and pr
vides a continuously variable d
source of supply for the polarizi
voltage. Leakage current is read
a 0-50 μa meter with a range of
ma. A high gained tuned amplifi
has made it possible to reduce t
bridge voltage to a value of 0.6

Consequently, the a-c voltage developed across the capacitor under test cannot exceed 0.4 v. To overcome $\tan^3$ values in excess of 75 experienced in low temperature tests, the instrument can be fitted with any value of $\tan^3$. United Mineral & Chemical Corp., 16 Hudson St., New York City.

Print No. Ins. 139 on Reader Service Card

Metering and Mixing System For Reactive Resins

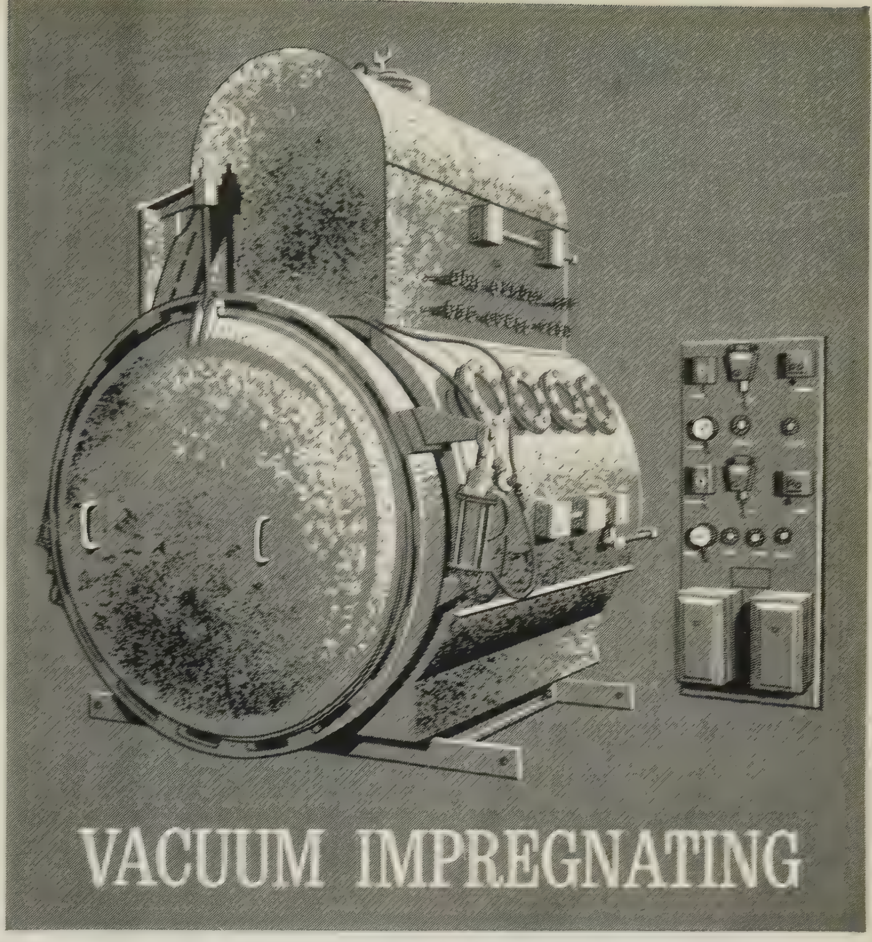
A lower-priced ($5,800) NoVo metering and mixing system for reactive resin systems, the new 100 series system incorporates many of the features of the original system selling at $9,800. The new unit is capable of both continuous flow and intermittent individual shots. It meters, mixes, and dispenses reactive liquid systems, including the polyurethane foams, polyurethane casting resins, epoxy resins, polyesters, polysulfides, silicones, etc. The 100 system comes complete with double-acting, electrically-driven, piston-type metering element; reservoirs; solvent purge system; all controls; and the same NoVo mixing head used on the more expensive system. The new unit is available in both mild and stainless steel and may be used in conjunction with all the standard accessories. Mitchell Specialty Div., Novo Industrial Corp., Edmund & Shelmire Sts., Philadelphia 36.



Print No. Ins. 140 on Reader Service Card

New Machine Cleans Wire Spools Automatically

A new automatic wire spool cleaner is said to clean 10 to 30 metal spools per minute. The model 50 cleaner is



J. P. Devine's Contribution to the Electrical Industry

Vacuum processing, first introduced into the United States over 50 years ago by J. P. Devine, opened whole new areas for the electrical industry, resulted in a better product at less expense.

Today, J. P. Devine remains one of the outstanding producers of vacuum processing equipment, still serves the electrical industry. Devine horizontal and vertical vacuum pressure units are now in daily use around the world helping to produce quality electrical products. For instance, the Devine impregnating system pictured above is completely automatic, unitized—and simultaneously processes 24 small integral KVA transformers. It produces a high capacity transformer, able to meet the most critical demands.

As are most Devine impregnators, this one was designed to solve a specific problem and produce a better product. They are adaptable to the most modern processes and materials; Devine impregnators, for instance, are ideal for processing with 100 per cent solid epoxy type resins. J. P. Devine engineers are happy to help you with electrical processing problems; learn how Devine Vacuum Impregnating can benefit you.

Write for our new Catalog No. 202, "Devine Vacuum Pressure Impregnators"

Other J. P. Devine Products for the Electrical Industry:
- Vacuum Drying Equipment
- Vulcanizers
- Mixers and Blending Equipment

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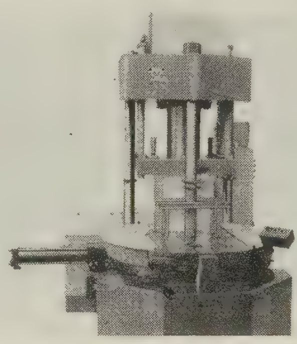
capable of wire brushing metal spools with barrel diameters up to 6″ and traverse up to 4″. Three motor-driven wire wheel units do the cleaning. Each contacts a different part of the spool as the 10-spindle turret revolves the spools through the machine. The first wheel cleans the barrel and the inside of the flanges. The second cleans the top radius of the flanges. Finally, a third wire wheel unit, top-mounted and adjusted at an angle, cleans the outside surface of the flange and removes any identification numerals. The wire wheels remove surface roughness and produce a bright new finish on the spools. Feed and spindle speeds can be varied according to the condition of the spools. The model 50 adjusts to produce from 10 to 30 pieces per minute at spindle speeds of 1000 to 3000 rpm. The J. M. Nash Co. Inc., 123 Jackson St., Oshkosh, Wis.

Print No. Ins. 141 on Reader Service Card

New Molding Press Allows Easier, More Accurate Insert Loading

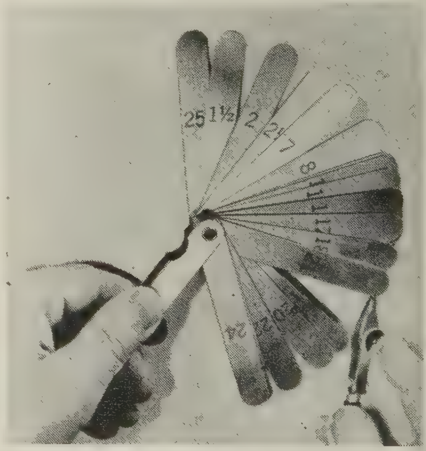
A new concept in the molding of plastic parts with inserts—providing easier and more accurate loading of the inserts into the mold, and reducing the amount of press idle time—is available in a new series of semi-automatic transfer molding presses, model 744. Extremely fast clamping speeds are said to make the presses ideally suited for compression molding also. The new presses have a horizontal turntable which carries, at opposite stations, two identical lower mold halves. While one of these lower mold halves is in the normal molding position within the press—for the pressing and curing phase of the cycle—the other lower mold half is outside of the press, in a convenient and accessible position for loading the inserts. The finished pieces are ejected automatically from the mold by rising vertical pins and are removed from the pins by the operator. All of the motions of the press are sequence-controlled, including the actuation of the turntable, and are completed automatically after the operator has pressed the cycle-start button for each cycle. F. J. Stokes Corp., Plastics Equipment Div., 5500 Taber Rd., Philadelphia 20.



Print No. Ins. 142 on Reader Service Card

New Device Presets Line Widths Of Ruling Pens, Compasses

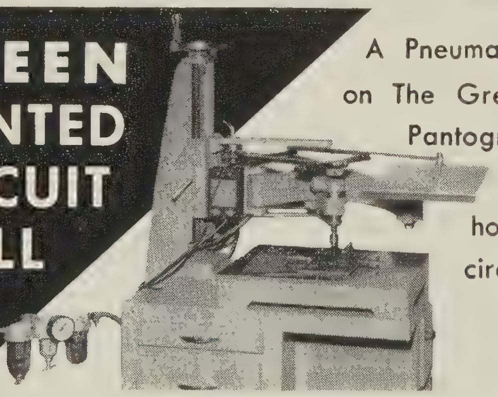
New "Line-Man" adjustor for setting ruling pens is a jack knife arrangement of 25 flat steel feelers, ranging in thickness from .0015″ to .025″. Inserted between the pen blades during adjustment, any of the clearly marked feelers will arrange for ink lines of corresponding width. It will match line with line, pen with compass, new work with old, department with department. Laramie Chemical Corp. P. O. Box 266, Ridgeway Station, Stamford, Conn.



Print No. Ins. 143 on Reader Service Card

Solderless Kit for Circuit Experiments

A new solderless kit is designed for the engineer or technician doing experimental circuit development. Designated as 25X, it is built around the new T-30 solderless "Springclip"



GREEN PRINTED CIRCUIT DRILL

A Pneumatic Attachment on The Green Model D2 Pantograph Engraver rapidly drills holes in printed circuits by tracing templates.

- Drill as many as 100 holes per minute, Foot switch actuates air powered operation.
- Drill speeds and feeds have independent adjustments. Feed regulated by air pressure.
- Spindle speeds up to 26,000 rpm. Permits use of carbide drills when required.
- D2-201 air attachment includes spindle air cylinder, regulating valve and pressure gauge, foot switch, filter and oiler, ready to operate when connected to compressor.

The Model D2 Heavy Duty Pantograph Engraver features ratios of 2 to 1 to infinity. Unobstructed on three sides to handle large work. Micrometer adjustment for depth of cut. Vertical range 10″ adjusting copy table automatically with pantograph.

GREEN INSTRUMENT COMPANY, INC.
Dept. 55 • 295 Vassar St. • Cambridge 39, Mass.

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terminal. Besides Springclips, the kit has a large 17″ × 8½″ perforated "Bectorbord" chassis for locating Springclips wherever desired, chassis frame, push-in zip terminals, wire, pot and switch brackets, extra Bectorbord pieces, and assembly hardware. Since all connections may be made without soldering, circuits may be developed faster and with no heat-damaged components. Kits are $19.50 each. Replacement parts may be purchased separately. Vector Electronic Co., 1100 Flower St., Glendale, Cal.

Print No. Ins. 144 on Reader Service Card

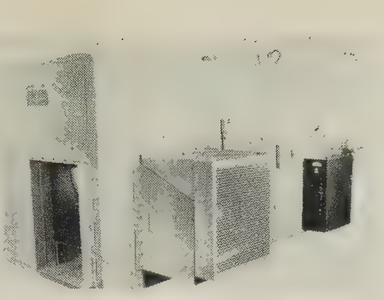
Portable Wheatstone Bridge

New portable wheatstone bridge is a compact and accurate slide wire bridge for resistance measurements of solid electrical conductors from 0.05 ohm to 50 kilo-ohms in 5 ranges. Special accessories are available for measuring electrolytic resistance. The instrument reportedly has a built-in highly sensitive moving coil galvanometer, with needle pointer and mirror scale for fine zero indication. The measuring voltage is provided by a built-in 4.5 v battery. Dimensions: 8″ × 4½″ × 2½″. A similarly built Kelvin bridge, range 5×10^{-5} to 2.1 ohm, is also available. Epic Inc., 150 Nassau St., New York 38.

Print No. Ins. 145 on Reader Service Card

Air Heaters for 450°F to 1250°F

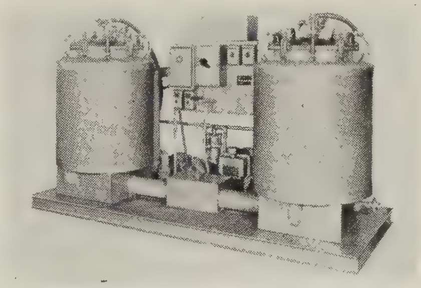
A new line of recirculating electric and gas-fired package air heaters with temperature ranges from 450°F to 1250°F are designed for application to user's heat processing equipment. The unit illustrated incorporates a non-overloading backward blade 11,766 CFM air circulation blower, indicating temperature controller, electronic flame safety devices with push button burner start-stop stations, built in dampers for control of air supply to the air heater, and observation ports to provide an unexcelled view of the the burner flame. Equivalent electrically heated models are available equipped with inconel sheathed tubular type heating elements to provide exceptionally long heater life, free from heater burn-out due to corrosive atmospheres. Grieve-Hendry Co. Inc., 1330 N. Elston Ave., Chicago 22, Ill.



Print No. Ins. 146 on Reader Service Card

High-Vacuum, High-Pressure Unit Impregnates Electrical/Electronic Parts

For impregnating transformer windings and other electrical and electronic parts, a 9-cu-ft model of the "Mogul" impregnator is said to produce excellent results with any impregnant, such as waxes and asphalts for use in heated machines and varnishes and resins in the unheated machines. The impregnator operates on a two-step cycle of high vacuum (29″ or more) and high pressure (100 lbs of air, nitrogen, or CO_2). Thorough removal of air and moisture from parts and positive penetration and coverage of the impregnant are stated to be assured. Each unit is shipped assembled and mounted on a structural steel base measuring 8 ft 6 in by 3 ft 6 in. Other sizes also available. Illustrated brochure available. Metallizing Co. of America Inc., 3520 West Carroll Ave., Chicago 24.



Print No. Ins. 147 on Reader Service Card

Wire Stripping Equipment

New "Glo-Melt" wire stripper is a cool, light, highly flexible handpiece with a Nichrome cutting element. It is designed to be used on the job or for bench work with optional foot control. Stripping of all plastic wire, including "Teflon," is accomplished

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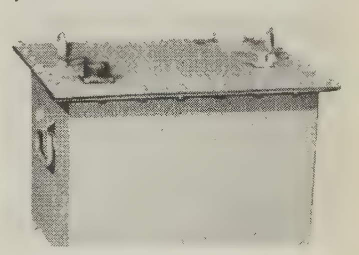
50,000 Volt DC HV Test Set



- Small size, light weight
- Rugged & reliable
- Low cost

Model S50-5DC is designed for dielectric testing, for leakage current measurements at high-voltage, and also used as a high voltage power supply for CRT work, electrostatic processes, sparking, corona generation, etc.

The oil-filled tank, less than 1 cu. ft. in volume, contains all HV components, metering facilities and automatic output shorting solenoid.

Selenium rectifiers are employed for ruggedness, long life and enhanced reliability. HV terminates in a shielded cable.

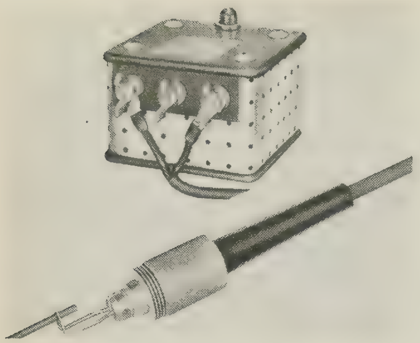
A fully instrumented control panel in cabinet or for rack mounting, not shown, provides all safety and convenience features.

The HV section pictured also available by itself without the control cabinet for use as a power unit.

Many other models available.

Telephone or write.

Peschel Electronics, Inc.
Phone TRinity 8-3251
Towners Patterson, N.Y.
Print Ins. 66 on Reader Service Card



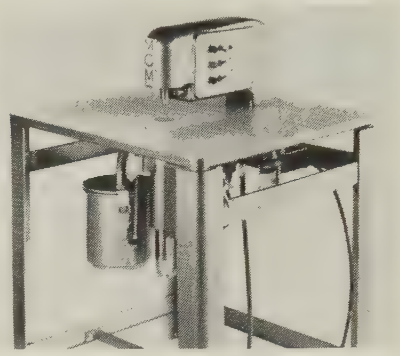
with a simple twist of the wrist. Wassco Glo-Melt Div., American Electrical Heater Co., 6110 Cass Ave., Detroit 2, Mich.
Print No. Ins. 148 on Reader Service Card

Corona Pick-Up Network

Corona pick-up network for those who have adequate scope facilities and a corona-free testing transformer consists of a corona-free high-voltage capacitor and a suitable RF choke with input and output connections. The network is an L-C voltage divider designed to resonate at approximately the correct frequency and to match the usual pulse amplifier/scope detector combination used in corona test sets. A large corona shield on top and single-ended mounting of corona-free capacitor is claimed to constitute ideal geometry for corona-free operation. The metal base measures 7″ × 7″ × 2″ and overall height is 15″. Corona pulses from this L-C divider are available at the BNC coaxial connector. Input to the pick-up network is the top corona shield and the grounded high voltage return post. Peschel Electronics Inc., R. F. D. #1, Patterson, N. Y.
Print No. Ins. 149 on Reader Service Card

Machine Drills up to 10,000 Panel Board Holes per Hour

The model M-100, primarily designed for high production drilling of printed circuit panel boards, is claimed to drill up to 10,000 holes per hour in epoxy glass—by drilling six 1/16″ stacked boards at one time. Using solid carbide drills, accuracy reportedly is maintained to ±.005. Any number of boards may be drilled to the 3/8″ maximum. The drilling operation is simple: Operator positions the drill jig and panel board stack under the stylus to ±1/16″ of true location and depresses the floor switch. The M-100 does everything else automatically. Motion Control Machines, 2704 West Burbank Blvd., Burbank, Cal.
Print No. Ins. 150 on Reader Service Card

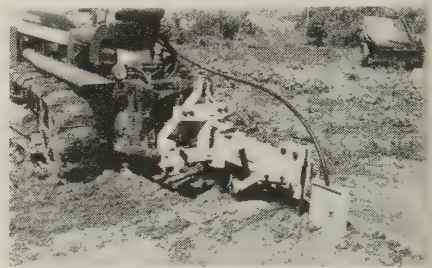


High Temperature Oven With Pull-Out Drawers

A new mechanical convected oven with pull-out drawers for preheating, drying, baking, curing, and other heat treating processes is said to have a temperature range of 35°C to 260°C ±0.5°C. Five separate drawers allow insertion, removal, and inspection of test items without disturbing the internal environment or other specimens. Drawers are constructed of aluminum, perforated to permit maximum air flow, and rendered airtight with asbestos gasketing. Controls include a wattage selector switch, automatic thermostat and overtemperature controller that cuts heater circuits automatically when chamber temperatures exceed the control setting. Interior measures 24″ × 20″ × 30″. The Electric Hotpack Co. Inc., 5022-A Cottman St., Philadelphia 35, Pa.
Print No. Ins. 151 on Reader Service Card

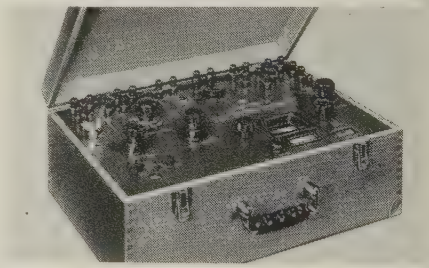
New Cable and Tubing Layer

New International No. 2 cable layer for utilities, telephone companies, contractors, and others desiring to bury cable, tubing, or pipe is a direct-connected, pivoted, layer available with a variety of hitch options to fit wheel or crawler tractors. The layer features a quick detachable inner shoe which enables the operator to remove cable or tubing without the necessity of cutting it, a roller equipped cable guide permits all types of cable or plastic tubing to be laid free of damage. International Harvester Co., 180 N. Michigan Ave., Chicago 1.
Print No. Ins. 152 on Reader Service Card



Transformer Test Set

New H & B instrument transformer test set METH 3 uses the differential method; secondary current ratings are 1, 5, and 10 and secondary voltage ratings are $100/\sqrt{3}$, $110/\sqrt{3}$, 100, 110 and $2.100/\sqrt{3}$ v, at frequencies ranging from 16⅔ to 60 cp. The instrument could use either a separate null indicator or could be supplied with built-in null indicator. Errors of current, voltage, and phase angle are all read at one point. The window for observing the galvanometer is located below the errors scale. The instrument is portable, 20″ × 15″ × 7″, and the weight is 33 lbs. Epic Inc., 150 Nassau St., New York 38.
Print No. Ins. 153 on Reader Service Card



New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Data on Expanded "Teflon" Tubing

Expanded Teflon tubing which recovers its original dimensions when heated is described in an illustrated, how-to-do-it bulletin. Bulletin 3E covers applications and method of use and lists sizes and recovered dimensions for thin and standard wall spaghetti from AWG 26 to 0, and for fractional-electrical and flexible tubings from 5/16″ to 1½″. All dimension tables are on one page and can be utilized as a convenient wall chart. 2 pages. Pennsylvania Fluorocarbon Co. Inc., 1115 N. 38th St., Philadelphia 4, Pa.

Print No. Ins. 201 on Reader Service Card

Epoxy Adhesives Properties Chart

A new adhesives properties chart contains the latest information on "Epibond" epoxy adhesives, their application, cure times, and properties. The reverse side of this chart contains such information as test methods, application suggestions, and availability. 2 pages. Furane Plastics Inc., 4516 Brazil St., Los Angeles 39.

Print No. Ins. 202 on Reader Service Card

Value Analysis Report on Plastics For Electrical/Electronic Uses

A new brochure describing the application of value analysis and its results to a series of different products and OEM parts covers industrial plastics applications in the electrical, electronic, and mechanical fields. Treated in a "before and after" manner, each example explains how the use of a Spaulding material improved design and utility, cut processing and assembly time, and reduced cost as high as 75%. Spaulding Fibre Co. Inc., 310 Wheeler St., Tonawanda, N. Y.

Print No. Ins. 203 on Reader Service Card

Bulletin on TFE-Fluorocarbon Tapes, Tubing, Rod, Shapes, and Parts

Bulletin BR-4 describes the full line of "Polypenco" TFE-fluorocarbon stock shapes and fabricated parts. Complete electrical, physical, thermal, and chemical property tables are included, and many representative applications for rod, tubing, tape, and sheet are illustrated. A separate section is devoted to "Fluorosint," a new TFE-fluorocarbon base composition, and lists property advantages as compared to TFE fluorocarbon parts, mill shapes available, and some application advantages. 8 pages. The Polymer Corp. of Penna., A Subsidiary of the Polymer Corp., Reading, Pa.

Print No. Ins. 204 on Reader Service Card

Booklet and Data Sheets on Applying Epoxies to Motor Windings

New booklet describes and illustrates each step in each of three basic methods of applying epoxy resins to motor windings: buttering, paste-and-pour, and casting with use of dikes. It also lists contents of kits in 1 to 50 lb quantities, in both flexible and semi-rigid forms. 8 pages. Two-page data sheets on two new class B resins, CB-1057 and CB-1058, also available, cover characteristics and application. John C. Dolph Co., Monmouth Junction, N. J.

Print No. Ins. 205 on Reader Service Card

Plastics Products Catalog

Newly revised and liberally illustrated catalog presents concise data on the physical, mechanical, and electrical properties and myriad applications of thermosetting phenolic and diallyl phthalate molding compounds,

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ELECTRITE: A hard board with high tensile strength. All punchings are clean and smooth. Sized with natural rosin to resist moisture. Available in brown or black. .031″ to .187″.

DENSITE: An extremely hard board with great tensile strength. Sized for moisture resistance or unsized for applications in oil. Natural kraft color. .031″ to .125″.

Ask for Underwriters' Laboratories report #E3987. Write Board Products Sales, West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, N.Y.

WV West Virginia Pulp and Paper

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phenolic bonding and coating resins, and "Hetron" fire-retardant polyester resins for reinforced plastic laminates and molded shapes. Text is supplemented by photos showing 35 typical product applications; a representative materials selection guide on 22 molding compounds of six different types encompassing choice of materials, their recommended uses, design advantages, and properties; and a similar properties-application chart for Hetron resins. 8 pages. Hooker Chemical Corp., Durez Plastics Div., 8 Walck Rd., North Tonawanda, N. Y.

Print No. Ins. 206 on Reader Service Card

Bulletin on Insulating Oils for Transformers, Cables, and Capacitors

New bulletin No. 58 gives technical information on electrical insulating oils for transformers and cables. The bulletin discusses the functions of a transformer oil; gassing characteristics of oils; properties of electrical oils; uses for inhibited and uninhibited oils; and typical properties of each type. Information on cable oils includes a discussion of the oil requirements of the three basic types of cables; viscosity-temperature relationships of cable oils; resistance to gas evolution; oxidation stability; and typical properties of six different types of insulating oils. 6 pages. Sun Oil Co., Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa.

Print No. Ins. 207 on Reader Service Card

Booklet on Benefits of Molded, Recessed Circuitry

New booklet describes and illustrates each of eight benefits to modern electronics provided by molded, recessed circuitry. The booklet also briefly describes a machine for assembling and soldering component parts into boards. 12 pages. Combined Electronics Inc., 6045 Ogden Ave., Cicero 50, Ill.

Print No. Ins. 208 on Reader Service Card

Nylon Insulated Fasteners Data

Latest additions of die cast zinc alloy and molded nylon fasteners are described in new supplement, bulletin No. 2002-1, to the company's complete fastener catalog. The bulletin includes descriptions, photographs and engineering drawings of new molded nylon and plastic-headed fasteners. These lightweight, self-insulating nylon fasteners include hex nuts, miniature machine screws, thumb nuts, and rivets. The new supplement (2 pages) and the complete catalog of standard and special purpose fasteners are both available. Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.

Print No. Ins. 209 on Reader Service Card

Data on Polyethylene Wire and Cable Insulating and Jacketing Compounds

Designed to assist fabricators in the selection of the most suitable material for a specific use, a new publication contains extensive data on each available "Bakelite" polyethylene for wire and cable. These data include detailed physical and electrical properties; listings of Bakelite polyethylene resins and compounds for wire and cable covered by ASTM Specification D1248-58T and Federal Specification L-P-590; and those materials covered by various Society and Government Specifications. Kabel-

Despite terrific temperature changes, abrasions and repeated immersions in acids, oils and water—these stainproof electrical tapes have demonstrated their ability to seal . . . hold . . . and insulate without weakening. 7000-G and 7100-G will meet your Class H insulation requirements.

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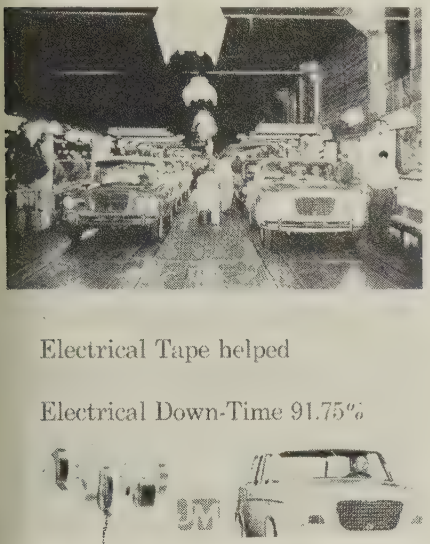
items No. 111, from Union Carbide Plastics Co., 270 Park Ave., New York 17.

Print No. Ins. 210 on Reader Service Card

New Booklet Tells How Electrical Tape Cut Costs

A new booklet tells how extra hours of vital production time were obtained through the use of a plastic electrical tape in the South Bend, Ind., plant of Studebaker-Packard. Use of the tape by one of the fastest-acting emergency crews in the industry cut downtime due to electrical failures 91.75%. Other important facts on the use of tape in maintenance are also given. 4 pages. Johns-Manville, Dutch Brand Div., 7800 South Woodlawn Ave., Chicago 19.



Print No. Ins. 211 on Reader Service Card

Solderless Termination Booklet

A new booklet tells the story of a customer service program and graphically illustrates the various analytical studies and procedures offered to manufacturers using electrical/electronic circuits in an effort to bring about more efficient and profitable production methods through use of solderless termination techniques and application tools. 12 pages. AMP Inc., Harrisburg, Pa.

Print No. Ins. 212 on Reader Service Card

Catalog on Plastic Insulating Tapes, Tubing, Sheet, Rod, and Parts

A new bulletin, AD-171, details plastic stock shapes and molded and fabricated parts available in "Teflon" nylon, "Delrin," CTFE ("Kel-F" or "Genetron"), and other industrial plastics used in the electronics in-

BIDDLE ELECTRICAL TESTING EQUIPMENT

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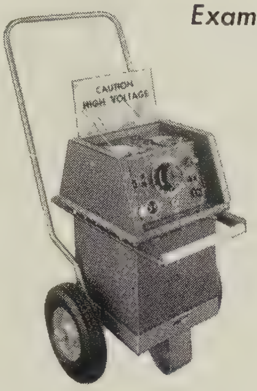


Example: **DIELECTRIC TEST EQUIPMENT**

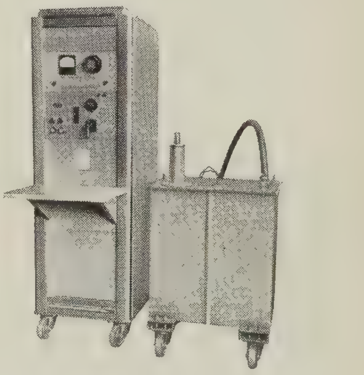
40 KV Model, illustrated, is a one-man portable set for maintenance d-c tests.

Equipment is compact and mobile. Maximum provisions have been made for safety. Operation is simple and performance is reliable. You get excellent output voltage regulation with facilities for voltage and leakage current measurements. In addition to the 40 KV set illustrated, two other models are available, one for operation up to 100 KV and one for operation to 5 KV. These have important uses for development work to test d-c dielectric strength of insulating materials and adequacy of design of insulation in equipment; also in production tests for non-destructively detecting defects in electrical insulation. ***WRITE FOR BULLETIN 22-IS***

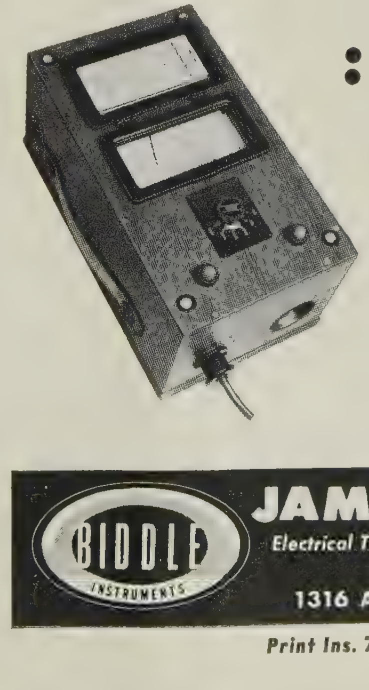
Example:
CORONA TEST EQUIPMENT

. . . for use in non-destructive or breakdown dielectric tests on electrical insulating materials, individual insulation structures and insulation of electrical equipment like cables, transformers, switchgear, rotating machinery, capacitors, bushings and communication apparatus . . . for measuring corona starting and extinction voltage, apparent corona charge, relative corona current.

Your inquiries for special applications are invited. A wealth of knowledge on Corona Testing will be placed cheerfully at your disposal. ***WRITE FOR BULLETIN 66-IS***



Example: **SIX-VOLTAGE MEGGER® INSULATION TESTER**



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Completely self-contained, one-man operated Megger Instrument designed to meet the growing needs for multi-voltage insulation tests. The new Six-Voltage Megger Insulation Tester is an important addition to the standard Megger Instruments available with up to 3 voltages: the Rectifier-Operated, Single-Voltage model with a range up to 200,000 megohms at 10,000 volts d-c, and the Rectifier-Operated, Triple-Voltage model with a range of up to 100,000 megohms at 5000 volts and 1000 and 2500 volt intermediate ranges. Complete details on the complete Biddle line of Megger Instruments are available on request. ***WRITE FOR BULLETIN 21-20-IS***

B-1008

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dustry. The publication lists complete specifications of standard sizes of Teflon sheet, extruded rod, tape, cementable tape, extruded tubing, molded bars and cylinders, as well as various types of filled Teflon TFE and fusion welded Teflon. Specifications are also given for "Chemiseal" nylon rod, slab, film, sheet, and tubing. Similar information is available on CTFE, Teflon FEP rod, and Delrin. 16 pages. Garlock Electronic Products, Garlock Inc., 447 Main St., Palmyra, N. Y.

Print No. Ins. 213 on Reader Rervice Card

Guide to Silicone Insulating Materials and Systems

New brochure describes a wide variety of silicone insulating materials and systems. Systems covered include components for form wound motors, randon wound motors, and transformers. Materials described include dipping and impregnating varnishes; encapsulants and potting materials (compounds and "Silastic" RTV); silicone rubber (pastes, tapes, dispersions, and RTV); adhesives for bonding coils and insulating components; compounds for sealing, coating, and filling; greases; and release agents. It also contains a guide to further information on silicones. 8 pages. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.

Print No. Ins. 214 on Reader Service Card

Revised Bulletin on Epoxy Electrical Impregnating Resin

A revised technical bulletin summarizes results of extensive research on the processing qualities of "Epocast" 3 electrical impregnating resin. Results of examination of viscosities for many days at room temperature, 150°F, and 200°F without accelerators are given. Also, cured specimens and the weight losses for different masses are shown for times up to 30 days at 300°F and 400°F. Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Cal.

Print No. Ins. 215 on Reader Service Card

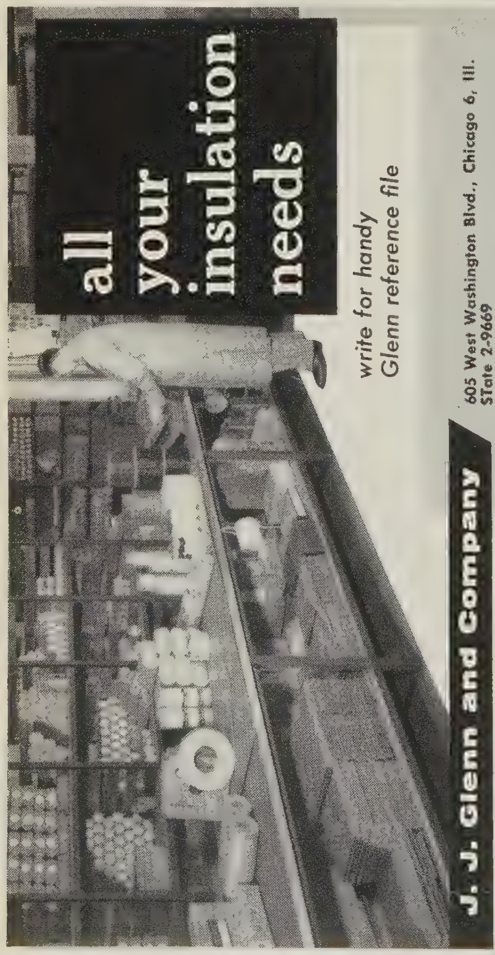
Brochure on Plastics Fabrication Facilities

A new facilities folder describes some of the precision techniques utilized in modern acrylics or thermoplastics manufacture. Titled "Ray Solves Difficult Problems In Plastics," the brochure outlines capabilities, facilities, and production methods employed by a plastics fabricating, machining, and vacuum forming firm. 4 pages. Ray Products Inc., 703 S. Palm Ave., Alhambra, Cal.

Print No. Ins. 216 on Reader Service Card

Booklet on Polyethylene Bulk Handling

A new booklet analyzes in detail, with the help of photographs, diagrams, charts, and tables, the factors to be considered in bulk ordering and handling of polyethylene resins, with particular reference to "Petrothene" polyethylene resins. The principal advantages of bulk purchasing of polyethylene, aside from the price allowances granted to bulk buyers, such as lower handling costs and warehousing expenses, more efficient processing of resin, and reduced hazards of resin losses and contamination, are pointed out. The booklet also points out that the savings resulting from bulk purchasing are reduced by interest on capital investment, mainte-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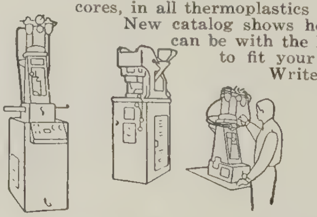

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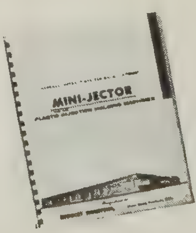

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nance and operating expenses, and other lesser expenses. Graphs and a handy table show how to figure net savings and the payout time for expenses incurred in installing bulk-handling equipment of all types. 24 pages. Technical Literature Dept., U. S. Industrial Chemicals Co., 99 Park Ave., New York 16.

Print No. Ins. 217 on Reader Service Card

Bulletin on Sintered Nylon Parts

New bulletin BR-1111 on "Nylasint" parts, nylon wear components formed by cold pressing and sintering nylon powders, contains data on three basic formulations available; property advantages; typical applications in the electrical, appliance, automotive, and other fields; property graphs; and illustrations of typical applications. 4 pages. Halex Corp., a subsidiary of The Polymer Corp., 2120 Fairmont Ave., Reading, Pa.

Print No. Ins. 218 on Reader Service Card

File Folder for PVC Resin Data

New folder for filing specification sheets and other data on a line of PVC resins also describes technical services available from the manufacturer. Enclosure is a detailed table of specifications for the three complete series of PVC resins offered. 1 page. Reprint titled, "New Vacuum Hopper Extracts Water and Air from Vinyl Insulation Prior to Extrusion," is also included and contains two tables of properties of the three PVC compounds extruded from dry blend showing the effect of the vacuum hopper and the effect of extrusion at various levels of screw cooling with and without vacuum hopper. 2 pages. Escambia Chemical Corp., 261 Madison Ave., New York 16.

Print No. Ins. 219 on Reader Service Card

Data Sheet Describes Plastic Welding Kit, Gives Plastic Sheet Prices

A new data sheet provides details on a new plastic welding kit designed for field or in-plant maintenance, or production welding of any thermoplastic fabrication. Also included in the data sheet is a complete listing of sizes and prices for sheet polyvinyl chloride (type I & II), branch and linear polyethylene, and polypropylene. This same information is included for the various types of plastic welding rod. 2 pages. American Agile Corp., P. O. Box 168, Bedford, Ohio.

Print No. Ins. 220 on Reader Service Card

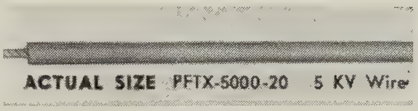
Plastic Molded Parts, Stampings, And Component Facilities Brochure

New brochure discusses electromechanical components (standard or fabricated to specifications), plastic stampings, and plastic molded parts for the automotive, aircraft, electrical, and electronic industries. Standard components described and illustrated include junction blocks, molded or fabricated sockets, terminal strips and boards, insulating-type shaft couplers, a-c interlocks, plugs, and jacks. 4 pages. Accurate Electronics Corp., 169 S. Abbe Rd., Elyria, Ohio.

Print No. Ins. 221 on Reader Service Card

Bulletin on Small, High Corona, High Voltage Cables

New laminated tape and dielectric oils, and extruded "Teflon" cable constructions are described in two bulletins titled "LSHV High Voltage" and "High Performance Cables." These lightweight miniature wires and cables are said to have exceptionally high corona thresholds. Engineering data covers voltage and temperature ranges, performance, tabular specifications, and applications. 4 pages each. Boston Insulated Wire & Cable Co., Bay St., Dorchester 25, Mass.



ACTUAL SIZE PFTX-5000-20 5 KV Wire

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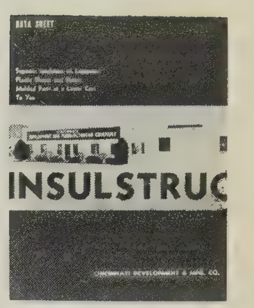
Catalog on Terminal Blocks And Accessories

A new and enlarged catalog lists many new items and developments in terminal blocks, switches, and accessories with complete mechanical and electrical information on all products. It also incorporates all data on the latest plastic insulating materials in a technical section, as well as the various terminal block configurations. Also covered is a new insulating strip that reportedly provides extra breakdown dielectric strength between the terminal hardware and the chassis on which the terminal



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Adhesion—Excellent
Taber-Abrasion—670 cycles per mil w/CS-17 wheel—1000 gram load
Thermal Shock—Good
Thermal Expansion—11.2x10⁻⁶ in/in °C. from 25°C. to 700°C.
Oil Resistance—Mil 7808, 6 months; Skydrol, 100 hours
Water Resistance—6 months room temp. & 180°F.
Dielectric Properties—Excellent
Thermal Resistance—6000°F., 15 sec. (carbonizes), 2000°F., continuous
Flame Resistance—2000°F.
Thermal Conductivity—Kc-600°F.—1.8 (BTU/hr/Ft/2/°F./in.), Kc-900°F.—2.2

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block is mounted. 36 pages. Kulka Electric Corp., 633-643 S. Fulton Ave., Mt. Vernon, N. Y.

Print No. Ins. 223 on Reader Service Card

Connector Facilities Booklet

New facilities booklet describes capabilities for design and manufacture of intricate miniature plastic and metal products, including a complete line of high reliability electrical connectors. Highlights covered include a large automatic machining department, hermetic sealing equipment, and precious metal plating facilities. A complete list of all equipment and facilities is given. 22 pages. Nu-Line Industries Inc., 1015 S. Sixth St., Minneapolis 4, Minn.

Print No. Ins. 224 on Reader Service Card

Multi-Conductor Cable and Hook-Up Wire Catalog

Comprehensive "Multi-Conductor Cable and Hook-up Wire" catalog covers "Teflon" TFE, Teflon FEP 100, and PVC constructions and describes design and engineering capabilities, including round and ribbon cables and assemblies. The catalog describes full lines of U/L approved Teflon wire, and Teflon FEP 100 hook-up wires. Reference sections provide much useful background information on various conductors and insulating materials. 18 pages. Times Wire and Cable Div., The International Silver Co., Wallingford, Conn.

Print No. Ins. 225 on Reader Service Card

Catalog of Industrial Ovens

New bulletin 71-TH describes a complete line of industrial high temperature, recirculating, gravity, and forced convection ovens for baking and curing of insulation materials and insulated units. In addition to the standard basic ovens, the catalog covers a variety of special designs for electrical heating applications. The new catalog also includes a discussion of the advantages of folded-and-formed ribbon-type resistance heating elements which reportedly allow extremely accurate process control over a wide temperature range, yet seldom, if ever, need replacement under normal operating conditions. 12 pages. Trent Inc., 211 Leverington Ave., Philadelphia 27, Pa.

Print No. Ins. 226 on Reader Service Card

Advantages of Vacuum Impregnation Set Forth in New Brochure

Improving the dielectric efficienc of large distribution transformers, th armatures of generators and motor ignition wiring systems, coils an capacitors, and components for rada and other electronic systems are som of the principal current application for vacuum impregnation, the advantages of which are presented i detail in the latest revised edition o catalog No. 652 on "Vacuum Impregnation." The brochure also describes an entire range of vacuu impregnating systems, with illustrations of a number of installations, an gives complete specifications fo standard impregnating chambers an impregnant storage tanks. 16 page F. J. Stokes Corp., 5500 Tabor Rd Philadelphia 20, Pa.

Print No. Ins. 227 on Reader Service Card

New Brochure Highlights Special Electronic Cables

New fold-out brochure highligh specialized electronic wire and cabl The folder, DM-S-6015, describe cable configurations available to cu tomer's specifications and stresse ability to make rapid delivery. It al details a wide variety of basic materials available for conductors, insulations, shields, jackets, and armor Illustrated cut-away sections sho construction of cables for electroni controls and check-outs, instrumen probes, airframes, missiles, satellite nuclear system controls and other instrumentation, communications, industrial and military TV cameras, an computers. The folder also notes som of the modern equipment used fo precision thermoplastic extrusion high-speed striping of color code conductors, and irradiated insulatio and jackets. 6 pages. Sequoia Wi & Cable Co., 2201 Bay Rd., Redwoo City, Cal.

Print No. Ins. 228 on Reader Service Card

Brochure Describes New Meter Conversion and Scale Service

Brochure summarizes a new mete and instrument service. Meter an instrument repair, meter calibratio and modification services, design an production of special scales, and ce tification services are covered. Mod fications of a variety of standard meters and some typical instruments which can be designed and produced to customer specifications are illustrated. 4 pages. Ram Meter Inc., 1100 Hilton Rd., Ferndale 20, Mich.

Print No. Ins. 229 on Reader Service Card

Pamphlet on Moisture And Its Measurement

Pamphlet on moisture and its measurement contains pertinent definitions, and discusses two methods (weight and volume) of determining the percentage of relative moisture and several methods of directly measuring moisture content with sensing probes. It also outlines the advantages of a moisture gage. 4 pages. Henry Francis Parks Laboratory, P. O. Box 1665, Lake City Station, Seattle 55, Wash.

Print No. Ins. 230 on Reader Service Card

Catalog Sheet on Distance Meter That Measures Dielectric Constant

A new illustrated catalog sheet describes the Type DM-100 distance meter, a portable and lightweight precision instrument that may be used to measure dielectric constant in addition to straight distance measurements and other special purposes such as dynamic balancing. Bulletin WK-DM-100 gives a general description of the distance meter, applications, and the operating principle, and discusses the instrument's probes and output connections. Specifications and a probe dimensions diagram are included. 2 pages. Wayne Kerr Corp., 1633 Race St., Philadelphia 3.

Print No. Ins. 231 on Reader Service Card

Leaflet Describes Solid State Abstracting Service

A leaflet describes a new technical abstracting service for solid state physicists and electronics engineers. Abstracts of papers on the theory, production, and use of solid state materials and devices (including semiconductors, magnetics, and dielectrics) are printed on 3″ x 5″ index cards to provide a cumulative, multiple-entry index to the solid state literature. Approximately 5000 cards will be supplied during the first year of publication. Cambridge Communications Corp., 238 Main St., Cambridge 42, Mass.

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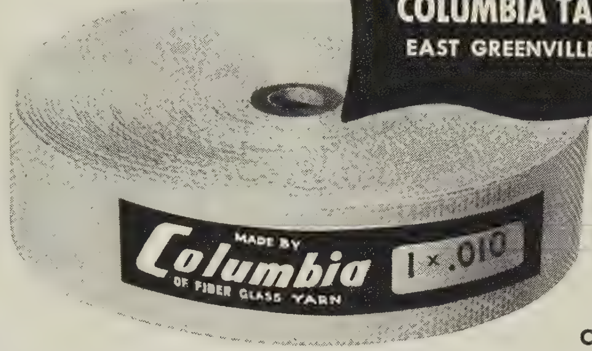

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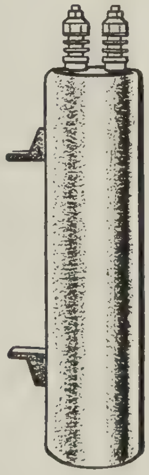

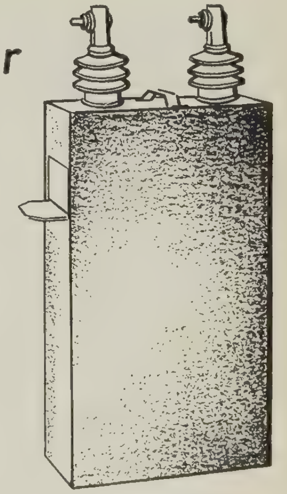

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Dates to Circle

Meeting and Convention Notices

Sept. 6-9 . . . Joint Automatic Control Conference, sponsored by AIEE, AICHE, IRE, ISA, and ASME, Kresge Auditorium, MIT, Cambridge, Mass.

Sept. 7-15 . . . 2nd International Coliseum Machinery Show, Coliseum, Chicago.

Sept. 9-10 . . . IRE, Conference on Communications, sponsored by Cedar Rapids Section, Roosevelt Hotel, Cedar Rapids, Iowa.

Sept. 13-16 . . . EIA, Fall Conference, French Lick, Ind.

Sept. 14-15 . . . 4th Annual Joint Military-Industrial Electronic Test Equipment Symposium, contact S. I. Cohn, Armour Research Foundation, 10 W. 35th St., Chicago.

Sept. 14-16 . . . AIEE-ASME, Engineering Management Conference, Morrison Hotel, Chicago.

Sept. 15-17 . . . EIA, Upper Midwest Electronic Conference, Minneapolis, Minn.

Sept. 19-22 . . . IRE, Space Electronics and Telemetry Convention and Symposium, Shoreham Hotel, Washington, D.C.

Sept. 21-23 . . . AIEE-ASME, National Power Conference, Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 22 . . . SPE Retec, Plastics in Business Machines, sponsored by Binghamton Section, Sheraton Inn, Binghamton, N.Y.

Sept. 23-Oct. 1 . . . English Domestic Electrical Apparatus Exhibition, Electrical Fairs Ltd., Alexandra Palace, London.

Sept. 26-28 . . . Standards Engineers Society, 9th National Convention, Pittsburgh Hilton Hotel, Pittsburgh, Pa.

Sept. 26-29 . . . American Welding Society, National Fall Meeting, Hotel Penn-Sheraton, Pittsburgh, Pa.

Sept. 26-30 . . . ISA, International Conference and Exhibit, Coliseum and Hotel New Yorker, New York City.

Sept. 28-30 (Tentative) . . . Canadian Electrical Manufacturers Assn., 16th Annual Meeting, Sheraton Brock Hotel, Niagara Falls, Canada.

Oct. 3-5 . . . IRE, Sixth National Commun cations Symposium, Hotel Utica an Utica Memorial Auditorium, Utica, N.

Oct. 3-5 . . . IRE, Annual Meeting of t Professional Group on Nuclear Scienc Gatlinburg, Tenn.

Oct. 3-7 . . . 21st Southern Textile Expo tion, Textile Hall Corp., Textile Ha Greenville, S.C.

Oct. 5 . . . SPE, Retec on "Plastics Corrosion," sponsored by Golden Ga Section, Mark Hopkins Hotel, San Fra cisco, Cal.

Oct. 5-6 . . . EIA, Second Conference Value Engineering, Disneyland Hot Anaheim, Cal.

Oct. 9-13 . . . Electrochemical Society Me ing, Shamrock Hilton Hotel, Housto Tex.

Oct. 9-14 . . . AIEE, Fall General Meeti Morrison Hotel, Chicago.

Oct. 10-12 . . . National Electronics Conf ence, sponsored by AIEE, IRE, and Il nois Institute of Technology, Hotel She man, Chicago.

Oct. 13-14 . . . SPI, 16th Annual New En land Section Conference, Wentworth-b the-Sea, Portsmouth, N.H.

Oct. 17-19 . . . Conference on Electrical I sulation, National Research Council—N tional Academy of Sciences, Nation Bureau of Standards and Shoreham H tel, Washington, D.C.

Oct. 19-21 . . . IRE, Symposium on Spa Navigation, Deshler-Hilton Hotel, Colu bus, Ohio.

Oct. 24-26 . . . IRE, East Coast Conferen on Aeronautics and Navigational Ele tronics, Lord Baltimore Hotel, Baltimo Md.

Oct. 27-29 . . . IRE, Electron Devices Me ing, Hotel Shoreham, Washington, D.C

Oct. 31-Nov. 2 . . . IRE, Radio Fall Me ing, Hotel Syracuse, Syracuse, N.Y.

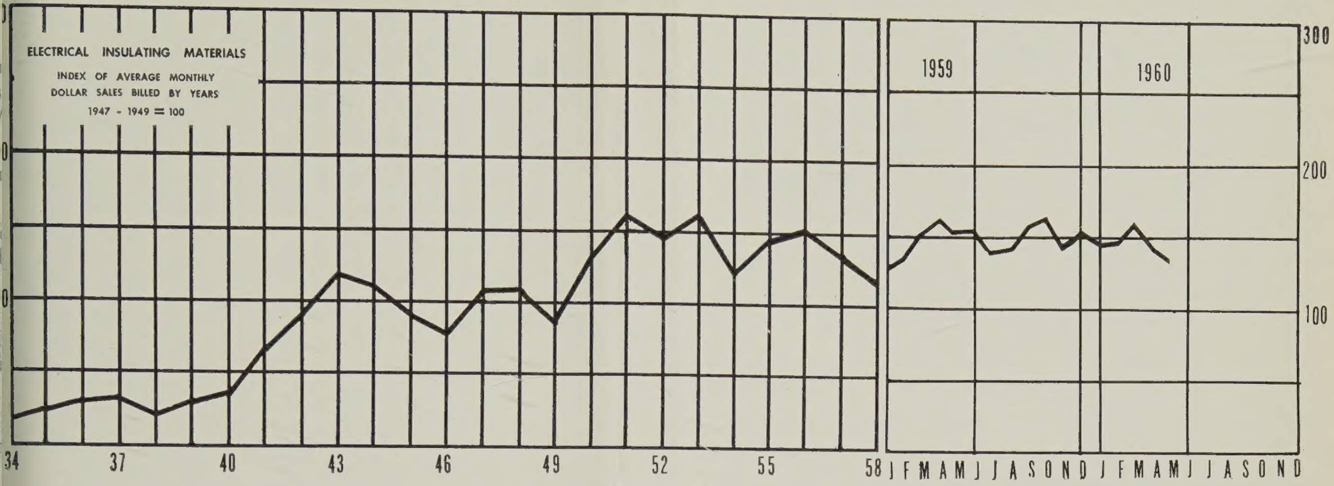
Oct. 31-Nov. 4 . . . IEC, General Meeti New Delhi, India.

Dec. 5-8 . . . Third National Conference the Application of Electrical Insulati Conrad Hilton Hotel, Chicago.

Abbreviations Used in Notices

AIEE —American Institute of Electrical Engineers
ASTM —American Society for Testing Materials
ASME —American Society of Mechanical Engineers
ASA —American Standards Assn.
IRE —Institute of Radio Engineers
EIA —Electronic Industries Assn.
NEMA —National Electrical Manufacturers Assn.
NISA —National Industrial Service Assn.
SPE —Society of Plastics Engineers
SPI —Society of the Plastics Industry
WEMA —Western Electronic Manufacturers Assn.

NEMA Electrical Insulation Index



	May '60	Apr. '60	May '59
dex series	134	140	153
pr. '60 point change from other mos.		—6	—19
pr. '60 % change from other months		—4	—12

dex is based on 1947-1949 average month, inclusive= 100

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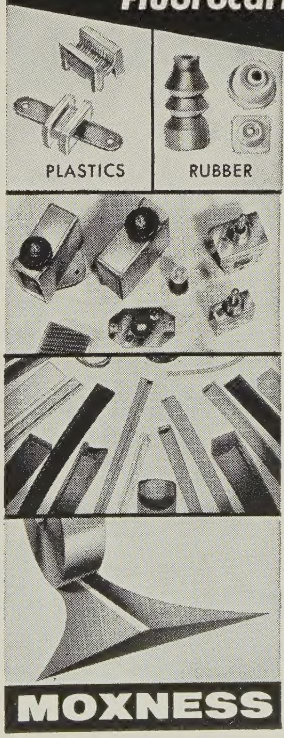

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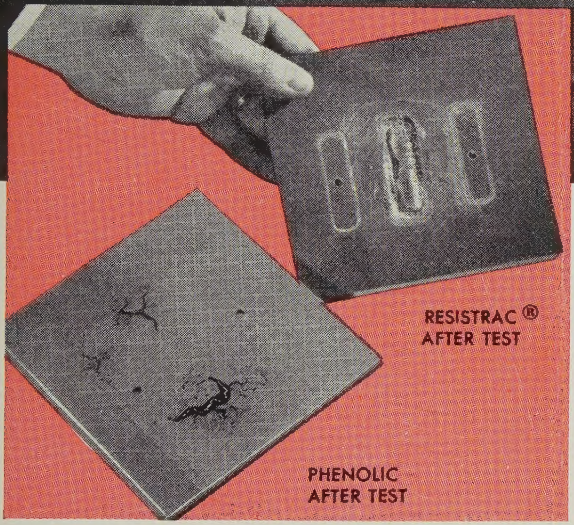

ABOVE: 10-sec. time exposure shows insulating material subjected to ASTM suggested dust & fog test. 1500 volts applied between electrodes causes arcing on the moist, contaminated surface.

LEFT: Samples of molding materials after test. Phenolic tracked to ground in 27 min. RESISTRAC is eroded after 648 hrs. but exhibits no carbon tracking.

New
GLASTIC RESISTRAC

This fiber glass reinforced alumina-polyester combines resistance to carbon treeing and dimensional stability approaching that of ceramics, and the toughness and precision of plastics. RESISTRAC offers the designer a material free from the tracking limitations of thermosetting plastics and without the shortcomings of ceramics.

Consider this excellent *combination* of properties:

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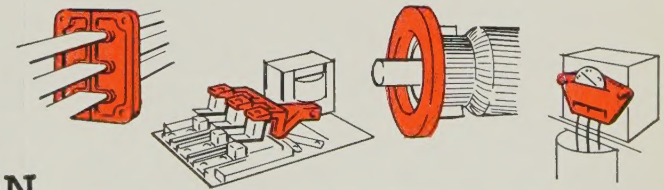
Flashover Resistance—Unlike ceramics, it gives shatter proof performance under the thermal shock of power flashover.

Chipping Resistance—From 3 to 6 foot pounds Izod impact strength compared with .05 to 1.0 foot pounds for most ceramics.

Flame Resistance—Completely self extinguishing. 90 sec. ign., 30 sec. ext. (Fed. Spec. LP 406b).

These design advantages plus heat resistance, low moisture absorption, and excellent moldability can offer real product improvement in apparatus where carbon tracking is a danger. And full design utilization of the properties can result in significant cost savings.

RESISTRAC is available in molded parts and in sheet stock. Write for engineering data.



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321 Glenridge Road Cleveland 21, Ohio

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Then we asked ourselves: *"Could we add to the quality of our magnet wire by building a plant to produce only magnet wire, nothing else?"*

The answer to both questions led to the construction of a brand-new Rea Magnet Wire plant at Lafayette, Indiana. Should a natural or man-made disaster occur, it is less likely to cause a serious interruption of your wire deliveries. The two Rea plants are over 100 miles apart, and are capable of producing identical types and sizes of magnet wire.

Most important, this new Rea plant is the only plant in the United States designed and built, *from the ground up*, exclusively for the production of magnet wire. New methods, new processes, new machinery (the end result of 26 years of wire-making experience) means a superior quality magnet wire for you. A wire that could not have been manufactured just a few short years ago.

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